

CSDG – 230kw

CUMMINS / DSHAD 230



**Sales and
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Cummins Sales and Service

NOTICE

A COPY OF THIS GENERATOR SET SUBMITTAL MUST BE RETURNED TO OUR OFFICE, APPROVED IN ITS ENTIRETY AND BEARING THE DATE OF APPROVAL, STAMP OR SIGNATURE AND TITLE OF THE APPROVING AUTHORITY, BEFORE ANY ITEM WILL BE RELEASED FOR MANUFACTURE OR SHIPMENT. WE ASSUME NO RESPONSIBILITY FOR DELAYS IN OUR FORECASTED SHIPPING SCHEDULES ON ANY ITEM ON WHICH SUBMITTAL APPROVAL IS BEYOND THIRTY (30) DAYS FROM THE SUBMISSION DATE ON THE COVER PAGE.

THIS SUBMITTAL IS BASED UPON OUR INTERPRETATION OF THE PROJECT REQUIREMENTS AND/OR SPECIFICATIONS AND IS IN ACCORDANCE WITH YOUR ORDER AND PRODUCT AVAILABILITY OF FROM OUR VENDORS. PLEASE REVIEW THE ENCLOSED DATA COMPLETELY AND CAREFULLY. SHOULD ADDITIONAL INFORMATION OR CLARIFICATION BE REQUIRED PLEASE FORWARD A SUBMITTAL COPY, COMPLETE WITH YOUR NOTATIONS, TO OUR OFFICE WITHIN THIRTY (30) DAYS FOR A PROMPT RESPONSE AND/OR RESUBMITTAL.

CONSIDERABLE ATTENTION IS GIVEN TO THE PREPARATION OF THIS SUBMITTAL TO ENSURE IT IS COMPLETE, CONCISE AND CORRECT AS IS POSSIBLE. PLEASE REVIEW IT CAREFULLY AND THOROUGHLY.



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Bill of Materials

ITEM NUMBER	DESCRIPTION	Quantity
1	<p>Commercial Diesel Generator Set, 230kW Standby 60Hz</p> <p>Genset-Diesel,60Hz,230kW</p> <p>U.S. EPA, Stationary Emergency Application</p> <p>Duty Rating - Standby Power (ESP)</p> <p>Listing - UL 2200</p> <p>Exciter / Regulator - Permanent Magnet Generator, 3 Phase Sensor</p> <p>Voltage - 277 / 480, 3 Phase, Wye, 4 Wire</p> <p>Alternator - 60Hz, 12 Lead, Upper Broad Range, 125C</p> <p>Emissions Certification, EPA, Tier 3, NSPS CI Stationary Emergency</p> <p>Steel Weather Protective Enclosure, with Exhaust System</p> <p>Skidbase - Housing Ready</p> <p>Fuel Tank - Dual Wall Sub Base, 24 Hour Capacity</p> <p>Listing, ULC - S601 - 07</p> <p>PowerCommand 2100 Generator Controller</p> <p>Backlit Digital Control Display</p> <p>Control Display Language - English</p> <p>Circuit Breaker or EB or TB - Left Only</p> <p>Circuit Breaker - 400A, Left, 3P, 600 / 690V, SS RMS, 80%, UL / IEC</p> <p>Engine Governor - Electronic, Isochronous</p> <p>Switch - Low Fuel Level, Sub Base</p> <p>Switch - Annunciator, Liquid In Rupture Basin</p> <p>Engine Cooling - Radiator, High Ambient Air Temperature, Ship Fitted</p> <p>Warning - Low Coolant Level</p> <p>Extension - Coolant Drain</p> <p>Coolant Heater - 120 Volt AC, Single Phase</p> <p>Genset Warranty - 2 Years Base</p> <p>Battery Rack</p> <p>Extension - Oil Drain</p> <p>Battery Charger-10Amp, 120/208/240VAC, 12/24V, 50/60Hz</p>	1



Diesel generator set QSL9-G2 series engine

175 kW - 230 kW Standby

Description

Cummins® commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary Standby and Prime Power applications.

Features

Cummins heavy-duty engine - Rugged 4-cycle, industrial diesel delivers reliable power, low emissions and fast response to load changes.

Alternator - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

Control system - The PowerCommand® electronic control is standard equipment and provides total genset system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

Cooling system - Standard integral set-mounted radiator system, designed and tested for rated ambient temperatures, simplifies facility design requirements for rejected heat.

Enclosures - Optional weather protective and sound attenuated enclosures are available.

Fuel tanks - Dual wall sub-base fuel tanks are also available.

NFPA - The genset accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

Warranty and service - Backed by a comprehensive warranty and worldwide distributor network.

Model	Standby rating		Prime rating		Continuous rating		Data sheets	
	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz	50 Hz
DSHAB	175 (219)		160 (200)				D-3451	
DSHAC	200 (250)		180 (225)				D-3452	
DSHAD	230 (288)		209 (261)				D-3453	

Generator set specifications

Governor regulation class	ISO 8528 Part 1 Class G3
Voltage regulation, no load to full load	± 0.5%
Random voltage variation	± 0.5%
Frequency regulation	Isochronous
Random frequency variation	± 0.25%
Radio frequency emissions compliance	Meets requirements of most industrial and commercial applications.

Engine specifications

Bore	114.0 mm (4.49 in)
Stroke	145 mm (5.69 in)
Displacement	8.9 L (543 in ³)
Configuration	Cast iron, in-line 6 cylinder
Battery capacity	1500 amps minimum at ambient temperature of -18 °C (0 °F)
Battery charging alternator	100 amps
Starting voltage	12 volt, negative ground
Fuel system	Direct injection: number 2 diesel fuel, fuel filter, automatic electric fuel shutoff
Fuel filter	Single element, 10 micron filtration, spin-on fuel filter with water separator
Air cleaner type	Dry replaceable element
Lube oil filter type(s)	Spin-on, full flow
Standard cooling system	High ambient radiator

Alternator specifications

Design	Brushless, 4 pole, drip proof revolving field
Stator	2/3 pitch
Rotor	Single bearing, flexible discs
Insulation system	Class H
Standard temperature rise	150 °C Standby at 40 °C ambient
Exciter type	Torque match (shunt)
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower
AC waveform Total Harmonic Distortion (THDV)	< 5% no load to full linear load, < 3% for any single harmonic
Telephone Influence Factor (TIF)	< 50 per NEMA MG1-22.43
Telephone Harmonic Factor (THF)	< 3

Available voltages

Three phase reconnectable				Single phase non-reconnectable	Three phase non-reconnectable	
• 120/208	• 120/240	• 127/220	• 139/240	• 120/241	• 220/380	• 347/600
• 240/416	• 254/440	• 277/480				

Note: Consult factory for other voltages.

Generator set options and accessories

Engine

- 120/240 V 1500 W coolant heater
- 120/240 V 150 W lube oil heater
- Heavy duty air cleaner
- Engine oil temperature

Fuel system

- 12 hour sub-base tank (dual wall)
- 24 hour sub-base tank (dual wall)
- 473 L (125 gal) sub-base tank (single wall)

Alternator

- 105 °C rise
- 125 °C rise
- 120/240 V 100 W anti-condensation heater
- PMG excitation

Exhaust system

- Single phase
- Genset mounted muffler
- Heavy duty exhaust elbow
- Slip on exhaust connection

Generator set

- AC entrance box
- Battery
- Battery charger
- Enclosure aluminum, steel, weather protective or sound attenuated
- Export box packaging
- UL 2200 Listed
- Main line circuit breaker
- PowerCommand Network Communications module (NCM)
- Remote annunciator panel
- Spring isolators
- 2 year Prime power warranty
- 2 year Standby power warranty
- 5 year Basic power warranty

Note: Some options may not be available on all models - consult factory for availability.

Control system PCC 2100



PowerCommand control is an integrated generator set control system providing governing, voltage regulation, engine protection and operator interface functions. Major features include:

- Integral AmpSentry™ Protective Relay providing a full range of alternator protection functions that are matched to the alternator provided.
- Battery monitoring and testing features and smart starting control system.
- Three phase sensing, full wave rectified voltage regulation system, with a PWM output for stable operation with all load types.
- Standard PCCNet™ and optional Echelon® LONWORKS® network interface.
- Control suitable for operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and altitudes to 5000 meters (13,000 feet).
- Prototype tested; UL, CSA, and CE compliant.
- InPower™ PC-based service tool available for detailed diagnostics.

Operator/display panel

- Off/manual/auto mode switch
- Manual run/stop switch
- Panel lamp test switch
- Emergency stop switch
- Alpha-numeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustments
- LED lamps indicating genset running, not in auto, common warning, common shutdown
- Configurable LED lamps (5)
- Configurable for local language

Engine protection

- Overspeed shut down
- Low oil pressure warning and shut down
- High coolant temperature warning and shut down
- High oil temperature warning (some models)
- Low coolant level warning or shut down
- Low coolant temperature warning
- High and low battery voltage warning
- Weak battery warning
- Dead battery shut down
- Fail to start (overcrank) shut down
- Fail to crank shut down
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication

Engine data

- DC voltage
- Lube oil pressure
- Coolant temperature
- Lube oil temperature (some models)
- Engine speed

AmpSentry AC protection

- Over current and short-circuit shut down
- Over current warning
- Single and three phase fault regulation
- Over and under voltage shut down
- Over and under frequency shut down
- Overload warning with alarm contact
- Reverse power and reverse Var shut down
- Excitation fault

Alternator data

- Line-to-Line and Line-to-Neutral AC volts
- Three phase AC current
- Frequency
- Total and individual phase power factor, kW and kVA

Other data

- Genset model data
- Start attempts, starts, running hours
- kW hours (total and since reset)
- Fault history
- Load profile (hours less than 30% and hours more than 90% load)
- System data display (optional with network and other PowerCommand gensets or transfer switches)

Governing

- Digital electronic isochronous governor
- Temperature dynamic governing
- Smart idle speed mode
- Glow plug control (some models)

Voltage regulation

- Digital PWM electronic voltage regulation
- Three phase Line-to-Neutral sensing
- Suitable for PMG or shunt excitation
- Single and three phase fault regulation
- Configurable torque matching

Control functions

- Data logging on faults
- Fault simulation (requires InPower)
- Time delay start and cooldown
- Cycle cranking
- PCCNet interface
- Configurable customer inputs (4)
- Configurable customer outputs (4)
- Configurable network inputs (8) and outputs (16) (with optional network)
- Remote emergency stop

Options

- LED bargraph AC data display
- Thermostatically controlled space heater
- Key-type mode switch
- Ground fault module
- Auxiliary relays (3)
- Echelon LONWORKS interface
- Modion Gateway to convert to Modbus (loose)
- PowerCommand iWatch web server for remote monitoring and alarm notification (loose)
- Digital input and output module(s) (loose)
- Remote annunciator (loose)

For further detail see document S-1409.

Emergency Standby Power (ESP):

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Limited-Time Running Power (LTP):

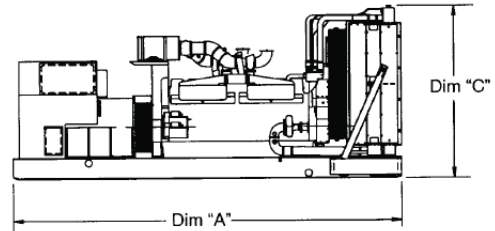
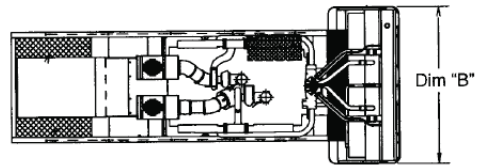
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

Prime Power (PRP):

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Base Load (Continuous) Power (COP):

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.



This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.





Do not use for installation design

Model	Dim "A" mm (in.)	Dim "B" mm (in.)	Dim "C" mm (in.)	Set weight* dry kg (lbs)	Set weight* wet kg (lbs)
DSHAB	2662 (104.8)	1016 (40.0)	1361 (53.6)		1561 (3442)
DSHAC	2662 (104.8)	1016 (40.0)	1361 (53.6)		1561 (3442)
DSHAD	2667 (105.0)	1016 (40.0)	1372 (54.0)		1469 (3238)

*Weights represent a set with standard features. See outline drawings for weights of other configurations.

Codes and standards

Codes or standards compliance may not be available with all model configurations – consult factory for availability.

	This generator set is manufactured in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.		The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage.
	The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.	U.S. EPA	Engine certified to Stationary Emergency U.S. EPA New Source Performance Standards, 40 CFR 60 subpart IIII Tier 3 exhaust emission levels. U.S. applications must be applied per this EPA regulation.
	All low voltage models are CSA certified to product class 4215-01.	International Building Code	The generator set package is available certified for seismic application in accordance with the following International Building Code: IBC2000, IBC2003, IBC2006, IBC2009 and IBC2012.

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

For more information contact your local Cummins distributor or visit power.cummins.com

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Generator Set Data Sheet



Model:	DSHAD
Frequency:	60 Hz
Fuel Type:	Diesel
kW Rating:	230 Standby 209 Prime
Emissions level:	EPA NSPS Stationary Emergency Tier 3

Exhaust emission data sheet:	EDS-1075
Exhaust emission compliance sheet:	EPA-1102
Sound performance data sheet:	MSP-1049
Cooling performance data sheet:	MCP-165
Prototype test summary data sheet:	PTS-162
Standard set-mounted radiator cooling outline:	0500-4303
Optional set-mounted radiator cooling outline:	
Optional heat exchanger cooling outline:	
Optional remote radiator cooling outline:	

Fuel Consumption	Standby				Prime				Continuous
	kW (kVA)				kW (kVA)				kW (kVA)
Ratings	230 (288)				209 (261)				
Load	1/4	1/2	3/4	Full	1/4	1/2	3/4	Full	Full
US gph	6.2	10.8	14.7	18.2	5.8	10.1	13.8	17.0	
L/hr	23	41	57	69	22	38	52	64	

Engine	Standby rating	Prime rating	Continuous rating
Engine manufacturer	Cummins Inc.		
Engine model	QSL9-G2 NR3		
Configuration	Cast iron, with replaceable wet cylinder liners, in-line 6 cylinder		
Aspiration	Turbocharged and CAC		
Gross engine power output, kW _m (bhp)	271.5 (364.0)	238.7 (320.0)	
BMEP at set rated load, kPa (psi)	1979 (287)	1816 (263)	
Bore, mm (in.)	114.0 (4.49)		
Stroke, mm (in.)	145 (5.69)		
Rated speed, rpm	1800		
Piston speed, m/s (ft/min)	8.7 (1707.0)		
Compression ratio	16.8:1		
Lube oil capacity, L (qt)	26.5 (28.0)		
Overspeed limit, rpm	2100 ± 50		
Regenerative power, kW	35.00		

Fuel Flow	Standby rating	Prime rating	Continuous rating
Fuel flow at rated load, L/hr (US gph)	162.8 (43.0)		
Maximum inlet restriction, mm Hg (in Hg)	152.4 (6.0)		
Maximum return restriction, mm Hg (in Hg)	254.0 (10.0)		

Air

Combustion air, m ³ /min (scfm)	20.9 (739.0)	20.8 (733.0)	
Maximum air cleaner restriction with clean filter, kPa (in H ₂ O)	3.7 (15)		
Alternator cooling air, m ³ /min (cfm)	41.3 (1460.0)		

Exhaust

Exhaust flow at set rated load, m ³ /min (cfm)	33.3 (1176)	31.0 (1157)	
Exhaust temperature, °C (°F)	600 (1110.0)	572 (1063.0)	
Maximum back pressure, kPa (in H ₂ O)	10.2 (41.0)		

Standard Set-Mounted Radiator Cooling (Non-Seismic)

Ambient design, °C (°F)	52 (126)	48 (118)	
Fan load, kW _m (HP)	16.4 (22)		
Coolant capacity (with radiator), L (US gal)	29.5 (7.8)		
Cooling system air flow, m ³ /min (scfm)	248 (8769)		
Total heat rejection, MJ/min (Btu/min)	7.8 (7374)	7.6 (7222)	
Maximum cooling air flow static restriction, kPa (in H ₂ O)	0.12 (0.5)		

Optional Set-Mounted Radiator Cooling

Ambient design, °C (°F)			
Fan load, kW _m (HP)			
Coolant capacity (with radiator), L (US gal)			
Cooling system air flow, m ³ /min (scfm)			
Total heat rejection, MJ/min (Btu/min)			
Maximum cooling air flow static restriction, kPa (in H ₂ O)			

Optional Heat Exchanger Cooling	Standby rating	Prime rating	Continuous rating
Set coolant capacity, L (US gal)			
Heat rejected, jacket water circuit, MJ/min (Btu/min)			
Heat rejected, aftercooler circuit, MJ/min (Btu/min)			
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)			
Maximum raw water pressure, jacket water circuit, kPa (psi)			
Maximum raw water pressure, aftercooler circuit, kPa (psi)			
Maximum raw water pressure, fuel circuit, kPa (psi)			
Maximum raw water flow, jacket water circuit, L/min (US gal/min)			
Maximum raw water flow, aftercooler circuit, L/min (US gal/min)			
Maximum raw water flow, fuel circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, jacket water circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, aftercooler circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, fuel circuit, L/min (US gal/min)			
Raw water delta P at min flow, jacket water circuit, kPa (psi)			
Raw water delta P at min flow, aftercooler circuit, kPa (psi)			
Raw water delta P at min flow, fuel circuit, kPa (psi)			
Maximum jacket water outlet temp, °C (°F)			
Maximum aftercooler inlet temp, °C (°F)			
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			

Optional Remote Radiator Cooling¹

Set coolant capacity, L (US gal)			
Max flow rate at max friction head, jacket water circuit, L/min (US gal/min)			
Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min)			
Heat rejected, jacket water circuit, MJ/min (Btu/min)			
Heat rejected, aftercooler circuit, MJ/min (Btu/min)			
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)			
Maximum friction head, jacket water circuit, kPa (psi)			
Maximum friction head, aftercooler circuit, kPa (psi)			
Maximum static head, jacket water circuit, m (ft)			
Maximum static head, aftercooler circuit, m (ft)			
Maximum jacket water outlet temp, °C (°F)			
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			
Maximum aftercooler inlet temp, °C (°F)			
Maximum fuel flow, L/hr (US gph)			
Maximum fuel return line restriction, kPa (in Hg)			

Weights²

Unit dry weight kgs (lbs)	
Unit wet weight kgs (lbs)	1561 (3442)

← see below drawings for overall shipping weight and dimensions

Notes:

¹ For non-standard remote installations contact your local Cummins representative.

² Weights represent a set with standard features. See outline drawing for weights of other configurations.

Derating Factors

Standby	Engine power available up to 1100 m (3600 ft) at ambient temperature up to 40 °C (104 °F). Consult your Cummins distributor for temperature and ambient requirements outside these parameters.
Prime	Engine power available up to 850 m (2800 ft) at ambient temperature up to 40 °C (104 °F). Consult your Cummins distributor for temperature and ambient requirements outside these parameters.
Continuous	

Ratings Definitions

Emergency Standby Power (ESP):	Limited-Time Running Power (LTP):	Prime Power (PRP):	Base Load (Continuous) Power (COP):
Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power to a constant electrical load for limited hours. Limited-Time Running Power (LTP) is in accordance with ISO 8528.	Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514. No sustained overload capability is available at this rating.

Alternator Data

Three phase table ¹		125 °C	125 °C	150 °C	150 °C						
Feature code	B414	B246	B268	B419							
Alternator data sheet number	213	212	212	212							
Voltage ranges	120/208 thru 139/240 240/416 thru 277/480	277/480	120/208 thru 139/240 240/416 thru 277/480	347/600							
Surge kW	233	233	233	233							
Motor Starting kVA (at 90% sustained voltage)	Shunt	770	212	770	770						
	PMG	920	920	920	920						

Full load current - amps at Standby rating	<u>120/208</u>	<u>120/240</u>	<u>139/240</u>	<u>220/380</u>	<u>277/480</u>	<u>347/600</u>
	799	629	629	399	346	277

Alternator Data (continued)

Single phase table ¹	125 °C									
Feature code	B414									
Alternator data sheet number	213									
Voltage ranges	120/240 ²									
Surge kW	233									
Motor Starting kVA (at 90% sustained voltage)	Shunt	420								
	PMG	500								
Full load current - amps at Standby rating		120/240 ² 639								

Notes:

- ¹ Single phase power can be taken from a three phase generator set at up to 2/3 set rated 3-phase kW at 1.0 power factor.
² The broad range alternators can supply single phase output up to 2/3 set rated 3-phase kW at 1.0 power factor.

Formulas for Calculating Full Load Currents:

Three phase output	Single phase output
$\frac{\text{kW} \times 1000}{\text{Voltage} \times 1.73 \times 0.8}$	$\frac{\text{kW} \times \text{SinglePhaseFactor} \times 1000}{\text{Voltage}}$

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

For more information contact your local Cummins distributor or visit power.cummins.com

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PowerCommand[®] 2100 Digital Generator Set Control



Description

The PowerCommand 2100 control is a microprocessor-based generator set monitoring, metering and control system. The control provides an operator interface to the genset, digital voltage regulation, digital governing and generator set protective functions. The integration of all the functions into a single control system provides enhanced reliability and performance compared to conventional control systems.

The PowerCommand control is designed for mounting on the generator set and is suitable for use on a wide range of generator sets in non-parallel applications. The PowerCommand control will directly read AC voltages up to 600 VAC and can be configured for any frequency, voltage and power connection configuration from 120 to 600 VAC.

The control offers a wide range of standard control and digital display features so custom control configurations are not needed to meet application specifications. System reliability is not compromised by use of untested special components.

Power for PowerCommand control is usually derived from the generator set starting batteries. It functions without degradation in performance over a voltage range from 8 VDC to 35 VDC.

Features

Digital engine speed governing controls - Provide isochronous frequency regulation (optional on some genset models).

Digital voltage regulation - 3-phase sensing.

AmpSentry™ protective relay - UL Listed, true alternator over current protection.

Analog and digital AC output metering.

Battery monitoring system - Senses and warns against a weak battery condition.

Digital alarm and status message display.

Generator set monitoring - Displays status of all critical engine and alternator functions.

Smart starting control system - Temperature dynamic integrated fuel ramping to limit black smoke and frequency overshoot, in addition to optimized cold weather starting.

PCCNet interface - A proprietary RS485 network interface to allow easy plug and play interface to remote annunciators, relay modules for extensible I/O and other devices.

Advanced serviceability - Interfaces to InPower™, a PC-based software service tool. A version of InPower is available for customer use.

PowerCommand LonWorks® network (optional) - Provides interfaces to external devices through a twisted pair wire and other media.

Certifications - Suitable for use on generator sets that are designed, manufactured, tested, and certified to relevant UL, NFPA, ISO, IEC, and CSA standards.

Warranty and service - Backed by a comprehensive warranty and worldwide distributor service network.

Operator Panel

The operator panel provides the user with a complete package of easy to view and use information. Connections to the operator panel are locking plug interfaces for reliable, vibration-resistant interconnection to the generator set wiring harness.

Control Switches and Functions

Off/manual/auto mode control switch - The *not in auto* lamp will flash when the control is in the *manual* or *off* mode. In the *auto* mode, the generator set can be started with a start signal from a remote device, such as an automatic transfer switch.

Manual run/stop control switch - When the mode control switch is in the *manual* position and the *manual/run/stop* switch is pressed, the generator set will start, bypassing time delay start. The control is configurable to include an idle period on manual start. If the generator set is running in the *manual* mode, pressing the *run/stop* switch will cause the generator set to shut down after a cool down at idle period.

Panel lamp/lamp test control switch - Depressing the *panel lamp* switch will cause the panel illumination to operate for approximately 10 minutes. Pressing and holding the switch will sequentially illuminate all LED lamps on the panel to confirm proper operation of these components.

Fault acknowledge/reset switch - The control includes a *fault acknowledge* function to allow the operator to reset the fault condition. If the fault condition is not corrected, the fault will reappear, but will not be logged as a separate event. Multiple faults can be logged and displayed at one time.

Emergency stop control switch - Pressing the *emergency stop* switch will cause the generator set to immediately shut down. The generator set is prevented from running or cranking with the switch pressed in.

Operator adjustments - The control includes provisions for many set up and adjustment functions via raise/lower switches on the operator panel. Functions that can be adjusted by the operator include:

- Time delay start (0-300 seconds)
- Time delay stop (0-600 seconds)
- Alternator voltage ($\pm 5\%$)
- Alternator frequency ($\pm 5\%$)

Indicating Lamps



The operator panel includes a series of LED indicating lamps to allow the operator to view the general status of the generator set. Functions displayed include:

Green lamps to indicate generator set running (operating at rated voltage and frequency); remote start signal received.

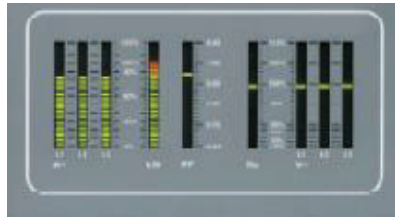
Red (flashing) lamp to indicate not-in-auto mode and a red lamp to indicate common shutdown.

Amber lamp for common warning.

Lamps (5) are configurable for color and function. These lamps are configured with InPower for any condition monitored by the control. Default configuration for these lamps include the following functions:

- Low oil pressure warning
- High engine temperature warning
- Low oil pressure shutdown
- Over speed shutdown
- Fail to start

Analog AC Metering Panel (Optional)



The PowerCommand control can be equipped with an analog AC metering panel that simultaneously displays 3-phase Line-to-Line AC volts and current, kW, power factor, and frequency.

The meter panel is composed of a series of LEDs configured in bar graphs for each function. The LEDs are color coded, with green indicating normal range values, amber for warning levels and red for shutdown conditions. Scales for each function are in % of nominal rated values. Resolution is 1% for values close to nominal and increases at values far from nominal.

Alphanumeric Display Panel



The PowerCommand control is provided with an alphanumeric display capable of displaying 2 lines of data with approximately 20 characters per line. The display is accompanied by a set of six tactile-feel membrane switches that are used by the operator to navigate through control menus and to make control adjustments. (There are no rotary potentiometers in the control. All adjustments are made via the display panel or InPower). Display is configurable for multiple languages. It is configurable for units of measurement.

All data on the control can be viewed by scrolling through screens with the navigation keys.

The control displays all active fault conditions with the latest displayed first. Active and inactive faults are displayed.

The display panel includes a screen-saver timer that will turn off the display after 30 minutes of inactivity. Touching any key will turn the screen back on.

Generator set hardware data - Generator set rating in kVA, complete generator set model number and provisions for generator set serial number, engine model and serial number, and alternator model and serial number. The control stores the part number of the control and the software version present in the control. This information is read using InPower.

Data logs - Number of start attempts and number of start attempts since reset. Number of times generator set has run and duration of generator set running time. Generator set kWh produced. The control also stores number of start attempts, operating hours and kW hours since each has been reset. This data is read with InPower.

Adjustment history - Provides a record of adjustment and setting changes made on the control and identifies whether adjustment was made via the operator panel or with a service tool. If a service tool is used, the control provides a record of the serial number of the tool used. This information is read with InPower.

Fault history - Provides a record of the most recent fault conditions with time stamp, along with the number of times each fault has occurred. Up to 20 events are stored in the control non-volatile memory.



Load profile data - Control logs data indicating the operating hours at percent of rated kW load in 10% increments. The data is presented on the operator panel based on total operating hours on the generator set based on number of hours under 30% load and number of hours at more than 90% of rated. InPower can be used to read data in detail (10% increments).

Generator set output voltage - All phases, Line-to-Line and Line-to-Neutral, accuracy 1%. Data for all phases is displayed simultaneously to allow viewing of voltage balance.

Generator set output current - All phases, accuracy 1%. Data for all phases is displayed simultaneously to allow viewing of load balance.

Generator set output frequency.

Generator set power output - PowerCommand displays generator set kW and kVA output (average and individual phase and direction of flow), and power factor with leading/lagging indication. Accuracy 5%.

Generator set kWh power output - Displays total kilowatt-hours produced by the generator set and total produced since last reset, with time stamp of time of last reset.

Generator set control temperature.

Engine starting battery voltage.

Engine lube oil pressure.

Engine coolant temperature.

Engine lube oil temperature (option on some genset models).

System data display - The generator set will exchange data with Cummins transfer switches utilizing PowerCommand transfer controls and other generator sets using the PowerCommand 2100 control that are located on the same site and interconnected using a PowerCommand network. Information displayed from each transfer switch in the system includes: transfer switch name (assigned by customer at site), kW load (when fitted with load monitoring equipment), sources available, source connected and if any alarm conditions are present on the switch. Genset data includes genset name, kW load, status and name of any alarm conditions that are present.

Service adjustments - The operator panel includes provisions for adjustment and set up of all control functions in the generator set. The operator panel includes an access code that is used to protect the control from unauthorized service level adjustments.

Internal Control Functions

Engine Control

Remote start mode - PowerCommand accepts a ground signal from remote devices or a network signal to automatically start the generator set and immediately accelerate to rated speed and voltage.

PowerCommand includes a smart starting system that is designed to quickly start the engine, minimize black smoke, minimize voltage and frequency overshoot, and oscillations on starting. The control system does this by careful control of the engine fuel system and alternator excitation system.

The control can incorporate a time delay start and a warmup period at idle speed. See *Engine governing* for details.

Sleep mode - PowerCommand can be configured to include a sleep mode. When enabled, and when the mode select switch is in the off position, the control will revert to a low power consumption mode until a control switch on the operator panel is operated (reset, panel lamp, manual run or emergency stop).

Data logging - The control maintains a record of manual control operations, warning and shutdown conditions, and other events. The control also stores critical engine and alternator data before and after a fault occurs, for use by InPower and the technician in evaluating the root causes for the fault condition.

Fault simulation mode - PowerCommand, in conjunction with InPower software, will accept commands to allow a technician to verify the proper operation of all protective functions of the control by simulating failure modes or by forcing the control to operate outside of its normal operating ranges.

Engine starting - The control system automatically controls the engine starter and provides proper engine fueling and alternator control to provide fast and efficient starting.

Cycle cranking - Configurable for number of starting cycles (1 to 7) and duration of crank and rest periods. Control includes starter protection algorithms to prevent the operator from specifying a starting sequence that might be damaging.

Time delay start and stop (cool down) - Configurable for time delay of 0-300 seconds prior to starting after receiving a remote start signal; and for time delay of 0-600 seconds prior to ramp-to-idle or shutdown after signal to stop in normal operation modes. Default for both time delay periods is 0 seconds.

Engine Governing

The PowerCommand control includes integrated digital governing capability to directly drive an engine fuel control valve. Features of the governing system (when enabled) include:

Isochronous governing - Controls engine speed within $\pm 0.25\%$ for any steady state load from no load to full load. Frequency drift will not exceed $\pm 0.5\%$ for a 33 °C (60 °F) change in ambient temperature over an 8 hour period.

Temperature dynamics - Modifies the engine fuel system (governing) control parameters as a function of engine temperature. Allows engine to be more responsive when warm and more stable when operating at lower temperature levels.

Engine Governing (Continued)

Smart idle mode - Engine governing can be regulated at an idle speed for a programmed period on automatic stop of the engine or in manual mode. In an automatic mode, the control will bypass the idle period if the engine is at a low load level for sufficient duration for cool down. During idle mode engine protective functions are adjusted for the lower engine speed, and alternator function and protections are disabled.

Idle speed can be initiated by the operator when the generator set is running in the manual mode.

Glow plug control (optional) - Modifies the engine start cycle to include a programmed time period for operation of glow plugs. This feature is available on generator sets that require glow plug control only.

Alternator Control

PowerCommand includes an integrated 3-phase Line-to-Neutral sensing voltage regulation system that is compatible with either shunt or PMG type excitation systems (some generator set models are always PMG). The voltage regulation system is full wave rectified and has a PWM output for good motor starting capability and stability when powering non-linear loads. Major system features include:

Digital output voltage regulation - PowerCommand will regulate output voltage to within 0.5% for any loads between no load and full load. Voltage drift will not exceed $\pm 0.5\%$ for a 33 °C (60 °F) change in temperature in an 8 hour period. On engine starting, or sudden load acceptance, voltage is controlled to a maximum of 5% overshoot over nominal level.

Torque-matched V/Hz overload control - The voltage roll-off set point and rate of decay (i.e. the slope of the V/Hz curve) is adjustable in the control.

Fault current regulation - PowerCommand will regulate the output current on any phase to a maximum of 3 times rated current under fault conditions for both single phase and three phase faults. The regulation system will drive a Permanent Magnet Generator (PMG) to provide 3 times rated current on all phases for motor starting and short circuit coordination purposes.

Protective Functions

On a warning condition the control will indicate a fault by lighting the warning LED on the control panel and displaying the fault name and code on the operator display panel. The nature of the fault and time of occurrence are logged in the control. The service manual and InPower service tool provide service keys and procedures based on the service codes provided.

On a shutdown condition, the control will light the shutdown LED on the control panel, display the fault name and code, initiate shutdown and lock out the generator set. The control maintains a data log of all fault conditions as they occur and time stamps them with the controller run time and engine operating hours data. Adjustments to most set points are made using the InPower service tool.

The control system includes a "fault bypass" mode that may be enabled by a service technician. The fault bypass mode forces the system to function regardless of the status of protective functions. (Each function must be individually bypassed.) In this mode the only protective functions that are operational are over speed, loss of speed sensor, moving the control switch to the off position or pressing the emergency stop switch.

The control maintains a record of the time that the mode is enabled, and all warning or shutdown conditions that have occurred while in the "fault bypass" mode.

The control system automatically captures the generator set logged parameters on a fault condition.

Many protective functions within the control system are configurable for warning, shutdown or both (2 levels). Exceptions to this include functions such as over speed conditions and loss of speed sensing. In addition, some functions can incorporate control functions as a consequence of a fault.

System Protective Functions

Ground fault warning (optional) - 600 VAC class generator sets with solid ground. Ground fault sensing is adjustable over a range of 100-1200 amps with time delays of 0-1 second. May be configured for shutdown rather than alarm.

Configurable alarm and status inputs - PowerCommand will accept up to four alarm or status inputs (configurable contact closed to ground or open) to indicate customer-specified conditions. The control is programmable for warning, shutdown or status indication, and for labeling the input. Eight additional faults can be input to the control via the network.

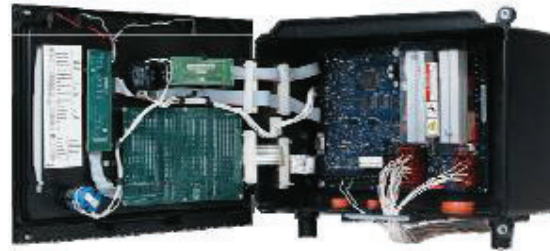
Emergency stop - Annunciated whenever the local or remote emergency stop signal is received. Alarm panel distinguishes between local or remote operation.

Engine Protection

Over speed shutdown - Default setting is 115% of nominal.

Low lube oil pressure shutdown - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.

Low lube oil pressure warning - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.



High coolant temperature shutdown - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.

High coolant temperature warning - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.

High oil temperature warning (optional) - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.

Low coolant level warning/shutdown - Optional on some genset models.

Low coolant temperature warning - Indicates that engine temperature may not be high enough for a 10 second start or proper load pickup.

Low and high battery voltage warning - Indicates battery charging system failure by continuously monitoring battery voltage.

Engine Protection (Continued)

Weak battery warning - The control system will test the battery bank each time the generator set is signaled to start, and indicate a warning if the generator set battery indicates impending failure.

Dead battery shutdown - Indicates that generator set failed to start due to failed starting battery.

Fail to start (overcrank) shutdown.

Fail to crank shutdown - Control has signaled starter to crank engine but engine does not rotate.

Redundant starter disconnect.

Cranking lockout - The control will not allow the starter to attempt to engage or to crank the engine when the engine is rotating.

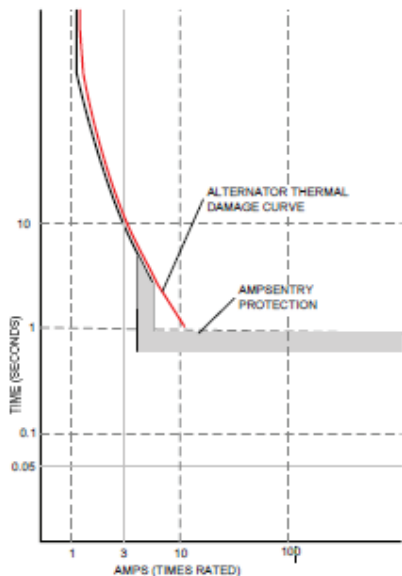
Sensor failure indication - All analog sensors are provided with sensor failure logic to indicate if the sensor or interconnecting wiring has failed. Separate indication is provided for fail high or low.

AmpSentry Protective Relay

AmpSentry protective relay is a UL Listed comprehensive monitoring and control system integral to the PowerCommand control system that guards the electrical integrity of the alternator and power system by providing protection against a wide array of fault conditions in the generator set or in the load. It also provides single and 3-phase fault current regulation so that downstream protective devices have the maximum current available to quickly clear fault conditions without subjecting the alternator to potentially catastrophic failure conditions. See document R1053 below for a full size time over current curve.

Over current warning - Output current on any phase at more than 110% of rating for more than 60 seconds or more than 400% for more than 1 second.

Over current shutdown (51) - Output current on any phase is more than 110%, less than 175% of rating and approaching thermal damage point of alternator. Control includes algorithms to protect alternator from repeated over current conditions over a short period of time.



Short circuit shutdown - Output current on any phase is more than 110%, more than 175% of rating, and approaching thermal damage point of alternator. Control includes algorithms to protect alternator from repeated over current conditions over a short period of time.

High AC voltage shutdown (59) - Output voltage on any phase exceeds preset values. Time to trip is inversely proportional to amount above threshold. Values adjustable from 105-125% of nominal voltage with time delay adjustable from 0.25-10 seconds. Default value is 110% for 10 seconds.

Low AC voltage shutdown (27) - Voltage on any phase has dropped below a preset value. Adjustable over a range of 50-95% of reference voltage, time delay 2-10 seconds. Default value is 85% for 10 seconds. Function tracks reference voltage.

Under frequency shutdown (81u) - Generator set output frequency cannot be maintained. Settings are adjustable from 0-10 Hz below nominal governor set point for a 0-20 second time delay. Default: 6 Hz, 10 seconds.

Over frequency shutdown/warning (81o) - Adjustable for operation in a range of 0-10 Hz above nominal frequency, with a time delay of 0-20 seconds. Defaults: disabled.

Over load (kW) warning - Provides a warning indication when engine is operating at a load level over a set point or due to under frequency. Adjustment range: 50-140% of rated kW, 0-120 second delay. Defaults: 105%, 60 seconds.

Reverse power shutdown (32) - Adjustment range: 5-20% of standby kW rating, delay 1-15 seconds. Defaults: 10%, 3 seconds.

Reverse Var shutdown - Shutdown level is adjustable: threshold 0.15-0.50 per unit, delay 10-60 seconds. Defaults: 0.20, 10 seconds.

Excitation fault - Shutdown of generator set will occur on loss of voltage sensing inputs to control.



Environment

The control is designed for proper operation without recalibration in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F), and for storage from 55 °C to +80 °C (-67 °F to +176 °F). Control will operate with humidity up to 95%, non-condensing. Control operation is not restricted by altitude.

The control system is housed in a NEMA 3R/IP53 enclosure. The operator control panel has a single membrane surface which is impervious to the effects of dust, moisture, oil and exhaust fumes. The panel uses sealed membrane or oil-tight switches to provide long reliable service life in harsh environments.

The control system is specifically designed and tested for resistance to RFI/EMI and to resist the effects of vibration to provide a long reliable life when mounted on a generator set. The control includes transient voltage surge suppression to provide compliance to referenced standards.

Control Interface

Input signals to the PowerCommand control include:

Remote start signal - May be connected via either discrete signal or Lon™ Network, or both.

Remote emergency stop.

Remote alarm reset.

Configurable customer inputs - Control includes (4) input signals from customer discrete devices that are configurable for warning, shutdown or status indication, as well as message displayed.

Output signals from the control include four configurable relay drivers. Defaults for these are:

Generator set common warning signal - Operates when unit set is running under alarm conditions.

Generator set common shutdown signal.

Not in auto - Indicates that the mode control switch is not in the auto position or that the genset is shutdown under a fault condition.

Ready to load (generator set running) signal -

Operates when the generator set has reached 90% of rated speed and voltage and latches until generator set is switched to *off* or *idle* mode.

Control power for auxiliary devices is available from the controller.

Network Connections Include:

PCCNet interface - A proprietary dedicated RS485 network for use in operating remote annunciator panels and remote I/O modules.

Serial interface - This communication port is to allow the control to communicate with a personal computer running InPower software.

Echelon® LonWorks interface (optional).

Software

InPower - A PC-based software service tool that is designed to directly communicate to PowerCommand generator sets and transfer switches to facilitate service and monitoring of these products.

PowerCommand for Windows® - A software tool that is used primarily by operators to remotely monitor and control generator sets, transfer switches and other on-site power system devices.

Warranty

PowerCommand control systems are a part of complete power systems provided by Cummins, and are covered by a one-year limited warranty as a standard feature.

Extended warranty options are available for coverage up to 10 years.

Certifications

PowerCommand meets or exceeds the requirements of the following codes and standards:

NFPA110: For Level 1 systems

UL 6200: Recognized and suitable for use on UL 2200 listed generator sets

CSA C282-M1999: Compliance

CSA 22.2: No. 14 M91 industrial controls

ISO 8528-4: 1993 compliance, controls and switchgear

NFPA99: Standard for health care facilities

CE Mark: Control system suitable for use on generator sets to be CE-marked

EN 50081-2: Industrial emissions

EN 50082-2: Industrial susceptibility

ISO 7637, pulses #2b, 4: DC supply surge voltage test

Mil Std 202C, Method 101: Salt fog test

ANSI C62.41: Surge withstand

IEC 801.2, 3, 4, 5: For susceptibility, conducted and radiated electromagnetic emissions

ISO9001: PowerCommand control systems and generator sets are designed and manufactured in ISO9001 certified facilities

Options and Accessories

- Analog AC metering display - Provides a bar graph display of 3-phase AC volts and amps, kW, power factor and frequency.
- Key-type mode select switch - Replaces off/manual/auto switch with a key-type switch.
- Ground fault alarm module - Installs a separate ground fault indication relay and harness into a control customer input.
- Exhaust temperature monitoring.
- Digital remote annunciator.
- Digital output relay module - Provides (3) relays, each with 2 normally open and 2 normally closed contacts rated 10 A at 600 VAC, 5 A at 24 VDC. Functions of the relays are configurable.
- Engine oil temperature indication - Some genset models incorporate this feature as standard. On all models, the control may be configured to include an oil temperature warning or shutdown when oil temperature sensing is provided.
- CAN engine interface (optional on some models). Allows the genset control to directly monitor an engine control module.
- LON interface.
- Input/output expansion module - Provides up to 16 configurable Form-C relays, 12 configurable discrete inputs and 8 analog inputs.

For more information contact your local Cummins distributor or visit power.cummins.com

Our energy working for you.™





Alternator data sheet

Frame size: **UCDI274K**

Characteristics								
Weights:		Wound stator assembly:	454 kg		1001 lb			
		Rotor assembly:	273 kg		602 lb			
		Complete alternator:	727 kg		1603 lb			
Maximum speed:			2250 rpm					
Excitation current:		Full load:	2 Amps					
		No load:	0.50 Amps					
Insulation system:			Class H throughout					
1 ∅ Ratings (1.0 power factor)		60 Hz (winding no)			50 Hz (winding no)			
(Based on specific temperature rise at 40 °C ambient temperature)		Double delta (311)		4 lead (06)	Double delta (311)		4 lead (05)	
		<u>120/240</u>		<u>120/240</u>	<u>110-120/220-240</u>		<u>110-120/220-240</u>	
125 °C rise ratings	kW/kVA	175/175		N/A	150/150		N/A	
105 °C rise ratings	kW/kVA	160/160		N/A	137/137		N/A	
3 ∅ Ratings (0.8 power factor)		Upper broad range (311)			Broad range (311)			
(Based on specified temperature rise at 40 °C ambient temperature)		120/208	127/220	139/240	110/190	115/200	120/208	127/220
		<u>240/416</u>	<u>255/440</u>	<u>277/480</u>	<u>220/380</u>	<u>230/400</u>	<u>240/415</u>	<u>254/440</u>
150 °C Rise ratings	kW	243	250	265	212	212	212	N/A
	kVA	304	313	331	265	265	265	N/A
125 °C Rise ratings	kW	233	239	250	200	200	200	N/A
	kVA	291	199	313	250	250	250	N/A
105 °C Rise ratings	kW	124	220	229	183	183	183	N/A
	kVA	167	275	286	229	229	229	N/A
80 °C Rise ratings	kW	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	kVA	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3 ∅ Reactances (per unit, ±10%)								
(Based on full load at 105 °C rise rating)								
Synchronous		2.90	2.67	2.34	2.59	2.34	2.17	N/A
Transient		0.14	0.12	0.11	0.12	0.11	0.10	N/A
Subtransient		0.09	0.08	0.07	0.08	0.07	0.07	N/A
Negative sequence		0.12	0.11	0.10	0.11	0.10	0.09	N/A
Zero sequence		0.02	0.02	0.02	0.02	0.02	0.02	N/A
3 ∅ Motor starting		<u>Broad range</u>		<u>LBR*</u>	<u>600</u>	<u>Broad range</u>		
Maximum kVA	(Shunt)	770				535		
(90% sustained voltage)	(PMG)	920				678		
Time constants (Sec)								
Transient		0.049			0.049			
Subtransient		0.020			0.020			
Open circuit		1.270			1.270			
DC		0.018			0.018			
Windings (@ 20° C)								
Stator resistance	(Line to Line, Ohms)	0.0126			0.0126			
Rotor resistance	(Ohms)	2.0800			2.0800			
Number of leads		12			12			

* Lower broad range 110/190 thru 120/208, 220/380 thru 240/416.



Prototype Test Supported Emergency/Standby Generator Sets Certification

Cummins Power Generation certifies that its commercial generator sets bearing the Prototype Test Supported (PTS) seal have been subjected to a design and development process that includes extensive prototype testing and evaluation. A PTS production model is engineered and manufactured according to documentation developed through comprehensive research, design and design verification.

Design verification is based on tests of preproduction prototype models manufactured specifically for prototype test purposes and not sold as new equipment. To be certified as a PTS model, the generator set must satisfy these prerequisites:

DESIGN - The PTS certified generator set must be designed specifically for emergency/standby applications that require high reliability and rapid response.

PROTOTYPE TESTING - Design suitability of the PTS certified generator set must be proven by tests on preproduction prototype models. The prototype test program is intended to:

1. Confirm the engine and generator have reserve capacity beyond rating to minimize the potential of damage or shutdown during steady state or transient loading conditions, including momentary overloads.
2. Demonstrate generator set, controls and accessories capability to perform reliably and compatibly in service during disturbances common in actual load circuits.
3. Verify the integrity of the generator and excitation system insulation systems and electrical components to withstand heating under rated load and transient overcurrent conditions.
4. Evaluate generator set mechanical and electrical strength to perform without damage during abnormal operating conditions, such as short circuits or out-of-phase paralleling. While operating at rated load, the generator set must be subjected to several 3-phase short circuits of 20 second duration. After the tests, the generator set is inspected to verify that no electrical or mechanical damage was incurred by any components.
5. Determine by endurance testing that no resonance conditions exist in the generator set or accessories that will cause premature failure of components on production units.
6. Investigate and identify failure modes to minimize the risk of any single component failure or human error that could lead to lack of essential electrical supply.
7. Provide a margin of safety, by actual trials, between the generator set component design and protection systems so that the components are not damaged before the protective devices activate a shutdown.

DOCUMENTATION AND SOFTWARE - The PTS certified generator set must be documented in a single drawing package with all components identified with Cummins Power Generation part numbers. A PTS test certificate must be created for each PTS generator set certifying the PTS testing performed.

QUALITY ASSURANCE - Engineering drawings, specifications and test requirements for a PTS certified generator set must be classified by components and assembly quality characteristics. A component and process inspection and test plan must be developed and maintained to measure product conformance to documentation requirements.

PRODUCTION MODEL TESTING - PTS certified generator sets must be subjected to complete production tests that demonstrate conformance to specifications at all rated conditions, including start-up, full load pickup and a performance run at full rated load and power factor.



Prototype Test Support (PTS) 60 Hz test summary



<u>Generator set models</u>		<u>Representative prototype</u>	
100DSHAF	175DSHAB	Model:	230DSHAD
125DSHAE	200DSHAC	Alternator:	UCDI274K
150DSHAA	230DSHAD	Engine:	QSL9-G2 NR3

The following summarizes prototype testing conducted on the designated representative prototype of the specified models. This testing is conducted to verify the complete generator set electrical and mechanical design integrity. Prototype testing is conducted only on generator sets not sold as new equipment.

Maximum surge power: 233 kW
The generator set was evaluated to determine the stated maximum surge power.

Maximum motor starting: 770 kVA
The generator set was tested to simulate motor starting by applying the specified kVA load at low lagging power factor (0.4 or lower). With this load applied, the generator set recovered to a minimum of 90% rated voltage.

Torsional analysis and testing:
The generator set was tested to verify that the design is not subjected to harmful torsional stresses. A spectrum analysis of the transducer output was conducted over the speed range of 1200 to 2000 RPM.

Cooling system: 52 °C ambient
0.5 in. H₂O restriction

The cooling system was tested to determine ambient temperature and static restriction capabilities. The test was performed at full rated load in elevated ambient temperature under static restriction conditions.

Durability:
The generator set was subjected to a minimum 500 hour endurance test operating at variable load up to the Standby rating based upon MIL-STD-705 to verify structural soundness and durability of the design.

Electrical and mechanical strength:
The generator set was tested to several single phase and three phase faults to verify that the generator can safely withstand the forces associated with short circuit conditions. The generator set was capable of producing full rated output at the conclusion of the testing.

Steady state performance:
The generator set was tested to verify steady state operating performance was within the specified maximum limits.

Voltage regulation: ± 0.5%
Random voltage variation: ± 0.5%
Frequency regulation: Isochronous
Random frequency variation: ± 0.25%

Transient performance:
The generator set was tested with the standard alternator to verify single step loading capability as required by NFPA 110. Voltage and frequency response on load addition or rejection were evaluated. The following results were recorded:

Full load acceptance:

Voltage dip: 29.1%
Recovery time: 3.2 seconds
Frequency dip: 12.6%
Recovery time: 3.7 seconds

Full load rejection:

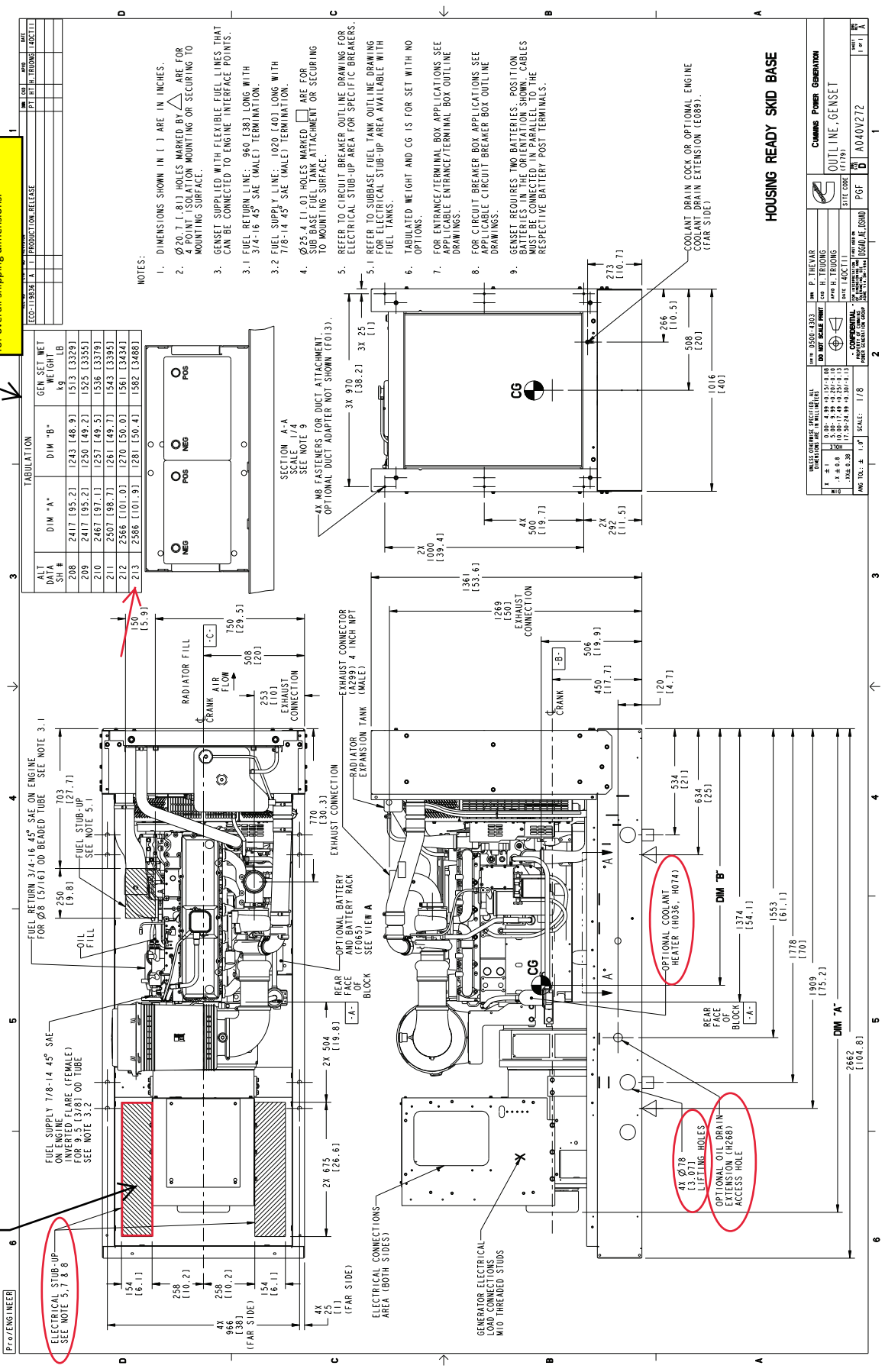
Voltage rise: 18.4%
Recovery time: 1.5 seconds
Frequency rise: 3.9%
Recovery time: 2.9 seconds

Harmonic analysis:
(per MIL-STD-705B, method 601.4)

Harmonic	<u>Line to Line</u>		<u>Line to Neutral</u>	
	<u>No load</u>	<u>Full load</u>	<u>No load</u>	<u>Full load</u>
3	0.06	0.18	0.23	0.14
5	0.89	0.79	0.82	0.76
7	0.73	2.05	0.72	2.00
9	0.03	0.03	0.77	0.00
11	0.09	0.64	0.05	0.62
13	0.04	0.53	0.05	0.53
15	0.01	0.00	0.13	0.00

add this weight to the enclosure and fuel tank weights for overall shipping weight.
Use the enclosure and fuel tank drawings for overall shipping dimensions.

400 amp breaker



HOUSING READY SKID BASE

P. THEVAR DESIGN ENGINEER DATE: 01/13/19	P. THEVAR DESIGN ENGINEER DATE: 01/13/19
STATE CODE: IL1938 PART NUMBER: 15040 JE (R0M)	STATE CODE: IL1938 PART NUMBER: 15040 JE (R0M)
SCALE: 1/8" = 1"	SCALE: 1/8" = 1"
SHEET NO. 1 OF 1	SHEET NO. 1 OF 1



Data Sheet

Circuit Breakers

Description

This Data sheet provides circuit breaker manufacturer part numbers and specifications. The Circuit breaker box description is the rating of that breaker box installation on a Cummins Generator. Please refer to the website of the circuit breaker manufacturer for breaker specific ratings and technical information.

Applicable Models

Engine	Models					
Kubota	C10D6	C15D6	C20D6			
QSJ2.4	C20N6	C25N6	C30N6	C30N6H	C36N6	C36N6H
	C40N6	C40N6H	C50N6H	C60N6H		
B3.3	C25D6	C30D6	C35D6	C40D6	C50D6	C60D6
QSJ5.9G	C45N6	C50N6	C60N6	C70N6	C80N6	C100N6
QSJ8.9G	C125N6	C150N6				
QSB5	DSFAC	DSFAD	DSFAE	C50D6C	C60D6C	C80D6C
	C100D6C	C125D6C				
QSB7	DSGAA	DSGAB	DSGAC	DSGAD	DSGAE	
		C125D6D	C150D6D	C175D6D	C200D6D	
QSL9	DSHAD	DQDAA	DQDAB	DQDAC		
QSM11	DQHAB					
QSX15	DFEJ	DFEK				

Instructions

1. Locate the circuit breaker feature code or part number and use the charts below to find the corresponding manufacturer circuit breaker catalog number.
2. Use the first letter of the circuit breaker catalog number to determine the "frame" of the breaker. If the first letter is an "N", use the second letter. Then follow the corresponding website link from the table below to find the breaker catalog number description.

Please refer to the catalog numbering systems page, which is given in the chart, to understand the nomenclature of the catalog number.

Frame	Catalog name*	Catalog number description page(s)
P	0612CT0101 http://www.schneider-electric.us/en/download/document/0612CT0101/	16-17
H, J, and L	0611CT1001 http://www.schneider-electric.us/en/download/document/0611CT1001/	8-9
Q	0734CT0201 http://www.schneider-electric.us/en/download/document/0734CT0201/	4

*The following link may also be used to search specifically by the breaker part number or for the catalog name listed above. <http://products.schneider-electric.us/technical-library/>

3. Search the catalog by using the first 3 letters of the breaker catalog number and the first 5 numbers to find information such as trip curves, accessories, and dimensional details regarding the circuit breaker.

*If the catalog number starts with "N", skip the N and begin your search with the second letter.

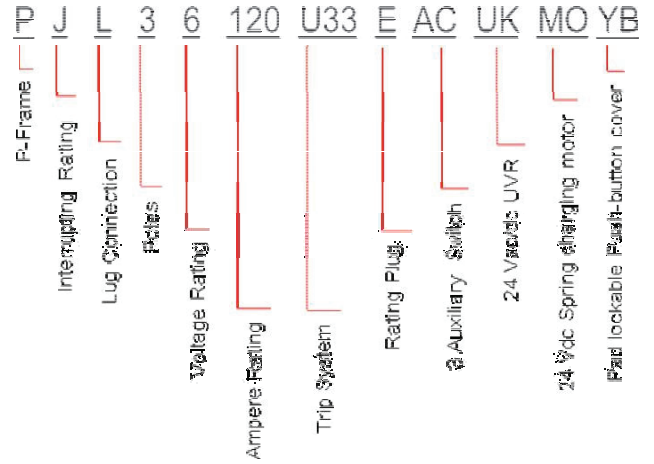
*If the first 3 letters are "PJP," the search will not work. You will need to start with just "PJ" and use the description pages to obtain the information you are looking for on the "PJP."

Example

After finding your circuit breaker catalog number to be "PJL36120U33EACUKMOYB," navigate to the P-frame catalog by using the link provided.

Look at pages 16-17 of the pdf catalog to find the nomenclature of the breaker.

Search the P-frame spec sheet using the search "PJL36120."



Feature Code	Breaker Box Description	Cummins Part #	Manufacturer	Breaker Catalog Number	Trip Unit	Plug Type
KU06-2	CirBrkr-400A, Right, 3P, 600/690V, SS RMS, 80%, UL/IEC	A045U083	Schneider Electric	NLGL36400U33XL Y-400A	MicroLogic 3.3S	N/A
KU07-2	CirBrkr-400A, Left, 3P, 600/690V, SS RMS, 80%, UL/IEC	A045U083	Schneider Electric	NLGL36400U33XL Y-400A	MicroLogic 3.3S	N/A
KU08-2	CirBrkr-450A, Right, 3P, 600/690V, SS RMS, 80%, UL/IEC	A045U082	Schneider Electric	NLGL36600U33X-450A	MicroLogic 3.3S	N/A
KU09-2	CirBrkr-450A, Left, 3P, 600/690V, SS RMS, 80%, UL/IEC	A045U082	Schneider Electric	NLGL36600U33X-450A	MicroLogic 3.3S	N/A
KU10-2	CirBrkr-500A, Right, 3P, 600/690V, SS RMS, 80%, UL/IEC	A045U081	Schneider Electric	NLGL36600U33X-500A	MicroLogic 3.3S	N/A
KU11-2	CirBrkr-500A, Left, 3P, 600/690V, SS RMS, 80%, UL/IEC	A045U081	Schneider Electric	NLGL36600U33X-500A	MicroLogic 3.3S	N/A
KU12-2	CirBrkr-600A, Right, 3P, 600/690V, SS RMS, 80%, UL/IEC	A044T468	Schneider Electric	NLGL36600U33X-600A	MicroLogic 3.3S	N/A
KU13-2	CirBrkr-600A, Left, 3P, 600/690V, SS RMS, 80%, UL/IEC	A044T468	Schneider Electric	NLGL36600U33X-600A	MicroLogic 3.3S	N/A
KU14-2	CirBrkr-800A, Right, 3P, 600/415V, SS RMS, 80%, UL/IEC	0320-2261-01	Schneider Electric	PJL36080U31F	MicroLogic 3.0 LI	F
KU15-2	CirBrkr-800A, Left, 3P, 600/415V, SS RMS, 80%, UL/IEC	0320-2261-01A	Schneider Electric	PJL36080U31F	MicroLogic 3.0 LI	F
KU16-2	CirBrkr-1200A, Right, 3P, 600/415V, SS RMS, 80%, UL/IEC	0320-2262-01	Schneider Electric	PJL36120U31E	MicroLogic 3.0 LI	E
KU17-2	CirBrkr-1200A, Left, 3P, 600/415V, SS RMS, 80%, UL/IEC	0320-2262-01A	Schneider Electric	PJL36120U31E	MicroLogic 3.0 LI	E
KV05-2	CB, Loc A, 15A, 2P, 600VAC, 80%, UL	A043E189	Schneider Electric	HDL26015	Thermal Magnetic	N/A
KV06-2	CB, Loc A, 20A, 2P, 600VAC, 80%, UL	A043E187	Schneider Electric	HDL26020	Thermal Magnetic	N/A
KV07-2	CB, Loc A, 25A, 2P, 600VAC, 80%, UL	A043E191	Schneider Electric	HDL26025	Thermal Magnetic	N/A
KV08-2	CB, Loc A, 30A, 2P, 600VAC, 80%, UL	A043E185	Schneider Electric	HDL26030	Thermal Magnetic	N/A
KV09-2	CB, Loc A, 40A, 2P, 600VAC, 80%, UL	A043E183	Schneider Electric	HDL26040	Thermal Magnetic	N/A

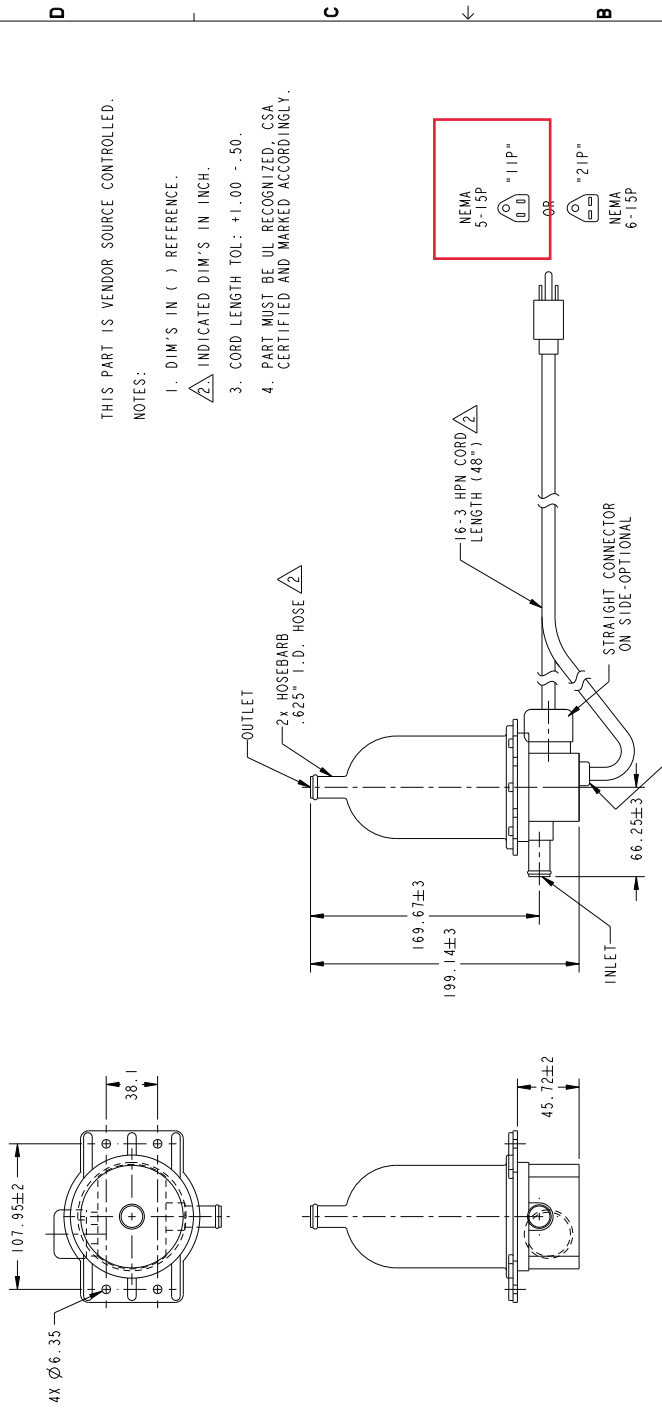
REV. NO.	DATE	BY	CHKD	APPROVED	DATE
ECO-120633	G	T	RELEASE	A041F653	

2

3

4

0333_0588



THIS PART IS VENDOR SOURCE CONTROLLED.

NOTES:

1. DIM'S IN () REFERENCE.
2. INDICATED DIM'S IN INCH.
3. CORD LENGTH TOL: +1.00 - .50.
4. PART MUST BE UL RECOGNIZED, CSA CERTIFIED AND MARKED ACCORDINGLY.

-THIS IS A CONTROLLED PRODUCT-
 PER DATA PROCEDURE REC 1002

TO MAINTAIN CONTROL OF THIS PRODUCT, THE FOLLOWING ARE REQUIRED:

DESIGN CONTROL FACILITY: INTERNAL EXTERNAL SUPPLIER

MANUFACTURING CONTROL FACILITY: INTERNAL EXTERNAL SUPPLIER

APPROVED BY: INTERNAL EXTERNAL SUPPLIER

APPROVED BY: INTERNAL EXTERNAL SUPPLIER

DESIGN CONTROL FACILITY: INTERNAL EXTERNAL SUPPLIER

MANUFACTURING CONTROL FACILITY: INTERNAL EXTERNAL SUPPLIER

APPROVED BY: INTERNAL EXTERNAL SUPPLIER

CLASSIFICATION OF CHARACTERISTICS

CRITICAL MAJOR MINOR (NONE)

APPROVED: R. GERKEN DATE: 12-07-95

LINE BELOW SYMBOL APPLIES TO UPPER LIMIT

LINE ABOVE SYMBOL APPLIES TO LOWER LIMIT

NO LINE WITH SYMBOL APPLIES TO BOTH LIMITS

KEY INSTRUCTION (NO TOLERANCE)

ONAN PART NO.	CURRENT ER	VOLTAGE	WATTAGE	THERMOSTAT SETTING
0333_0588_01	FRD3713	120	1000	80-100°F
0333_0588_02	FRD3713	208/240	750/1000	80-100°F
0333_0588_03	FRD3713	120	1500	80-100°F
0333_0588_04	FRD3713	208/240	1125/1500	80-100°F
A041F653	ECO-120633	120	1000	60-80°F

ITEM NO.	ITEM	PART NO.	QTY	DESCRIPTION OR MATERIAL
				Minneapolis, Minnesota 55432
				HEATER-ENG-COOLANT
				0333_0588



Enclosures and tanks

35-230 kW gensets



Enclosure features

- 14-gauge, low carbon, hot-rolled ASTM A569 steel construction (panels)
- 12-gauge, low carbon, hot-rolled ASTM A569 steel construction (posts)
- Stainless steel hardware
- Compact footprint
- Zinc phosphate pre-treatment, e-coat primer and super durable powder topcoat paint minimize corrosion and color fade
- Package listed to UL 2200
- Fuel and electrical stub-up area within enclosure perimeter
- Two or three recessed doors per side, depending on generator set dimensions, for service access
- Doors key and padlockable for added security
- Weather protective seals around all doors on sound-attenuated enclosures
- Enclosed exhaust silencer improves safety and protects against rust
- Critical sound level exhaust silencers in sound-attenuated enclosures
- Rain collar and rain cap
- Non-hydroscopic sound-attenuating material
- Easy access lifting points for spreader bars or forklift, depending on model
- Compatible with most under-set fuel tanks
- Enclosure attaches directly to generator set skid base or fuel tank, depending on model
- Designed for ambient temperatures up to 50 °C (122 °F)
- Refer to genset model cooling system data sheets for specific capabilities
- Enclosures are designed for outdoor use only

Options

- Two levels of sound attenuation, and weather protective enclosure, steel and aluminum (most models)
- Super durable powder coat painted aluminum construction minimizes corrosion and color fade, panels and posts.1" thick, ASTM B209, 5052 H32
- Aluminum wind rated to 150 mph (per ASCE 7-05 exposure D, category 1 importance factor) (also available on some steel enclosures)
- Window for control viewing
- Kits to up fit existing gensets or to upgrade existing enclosures with additional sound attenuation
- Exterior oil and coolant drains with interior valves for ease of service
- Overhead 2-point lifting brackets (some models)

Fuel tank features

- Rectangular, heavy gauge, welded steel construction
- UL 142 Listed
- ULC-S601-07 Listed
- NFPA 37 compliant
- Double wall with a sealed, separately vented, integral fuel containment basin
- Reinforced steel box channels for generator support
- Full height gussets provided at genset mounting holes
- Interior coated with a solvent-based rust preventative
- Emergency pressure relief vent cap
- Port for normal vent
- Top-mounted fuel gauge
- Fuel supply and return tubes

- Raised fuel fill
- Mounting brackets for optional pump and control
- Ground clearance to minimize bottom rusting
- Integral lifting points
- Tanks are leak-checked to ensure integrity of weld seams prior to shipment

Options

- Fuel pump and control
- Low fuel level switch
- Leak detection rupture basin switch
- Fuel level control float valve (some models)
- Accessory kits for U.S. regional codes (some models)

Dual wall sub-base fuel tanks – usable operating hours

Genset model	Gallons/hour at full load	70 gallon tank	109 gallon tank	140 gallon tank	173 gallon tank	185 gallon tank	309 gallon tank	336 gallon tank	376 gallon tank	Gallons fuel after low level switch
30 DGHCA	2.4	12, 24		48						4.96
35 DGHCB	2.7	12, 24		48						4.96
35 DSFAA	3.8	18		37						4.96
40 DGHCC	3.1	12		24		48				6.96
40 DSFAB	4.5	16		31						4.96
50 DGCA	4.2	17		33						4.96
50 DSFAC	5.1	14		27						4.96
60 DGCB	4.7	15		30						4.96
60 DSFAD	5.9	12		24						4.96
80 DGCG	6.3	11		22						4.96
80 DSFAE	6.9	10		20						4.96
100 DSGAA	8.5						36			21
125 DSGAB	10.0						30			21
150 DSGAC	12.2						25			21
175 DSGAD	13.1								28	23
200 DSGAE	14.8								25	23
230 DSHAD	18.2		6		10			18		

Operating hours are measured at 60 Hz, Standby rating.

Enclosure package sound pressure levels @ 7 meters dB(A)

Genset model	Weather protective enclosure steel: F182 aluminum: F216*	Level 1 sound attenuated enclosure steel: F172 aluminum: F231*	Level 2 sound attenuated enclosure steel: F173 aluminum: F217*	Level 3 sound attenuated enclosure steel: F232 aluminum: F233*
Natural gas				
35 GGPA	82	74	63	N/A
40 GGPB	83	74	65	N/A
45/50 GGPC	83	74	65	N/A
60 GGHE	86	77	68	N/A
70/75 GGHF	87	77	69	N/A
85 GGHG	80	76	70	N/A
100 GGHH	80	76	70	N/A
125 GGHJ	86	82	75	N/A
Diesel				
30 DGHCA	76	68	62	N/A
30 DGHCB	76	68	62	N/A
35 DSFAA	87	79	70	N/A
40 DGHCC	76	69	62	N/A
40 DSFAB	87	79	70	N/A
50 DGCA	83	72	66	N/A
50 DSFAC	87	79	70	N/A
60 DGCB	84	73	67	N/A
60 DSFAD	87	79	71	N/A
80 DGCG	84	76	67	N/A
80 DSFAE	87	82	72	N/A
100 DSGAA	87	N/A	72	69
125 DSGAB	88	N/A	73	69
150 DSGAC	88	N/A	73	70
175 DSGAD	89	N/A	74	70
200 DSGAE	89	N/A	74	71
230 DSHAD	96	89	78	N/A

Where two natural gas ratings are shown above, the first is the natural gas rating and the second is the propane rating. Data is a measured average of 8 positions, and is 60 Hz, full load Standby rating, steel enclosures only.

*Sound levels on aluminum enclosures are approximately 2 dB(A) higher than steel as measured above.

Diesel package dimensions of enclosure, exhaust system and UL tank

Weather protective

Kilowatt rating	Tank size	Length (in.)	Width (in.)	Height (in.)	Weight (lbs)
35 - 80 kW	70 gallon tank	83	40	65	810 steel, 729 aluminum
	140 gallon tank	83	40	73	960 steel, 879 aluminum
	185 gallon tank	83	40	77	1062 steel, 981 aluminum
100 - 230 kW	109 gallon tank	105	40	69	1010 steel, 888 aluminum
	173 gallon tank	105	40	74	1136 steel, 1014 aluminum
	309 gallon tank	105	44	88	4838 steel, 4416 aluminum
	336 gallon tank	105	40	88	1369 steel, 1247 aluminum
	376 gallon tank	138	43	90	5563 steel, 5141 aluminum

Level 1 sound attenuated

Kilowatt rating	Tank size	Length (in.)	Width (in.)	Height (in.)	Weight (lbs)
35 - 80 kW	70 gallon tank	83	40	88	1246 steel
	140 gallon tank	83	40	94	1396 steel
	185 gallon tank	83	40	95	1498 steel
100 - 230 kW	109 gallon tank	108	40	87	1510 steel
	173 gallon tank	108	40	92	1636 steel
	336 gallon tank	108	40	106	1869 steel

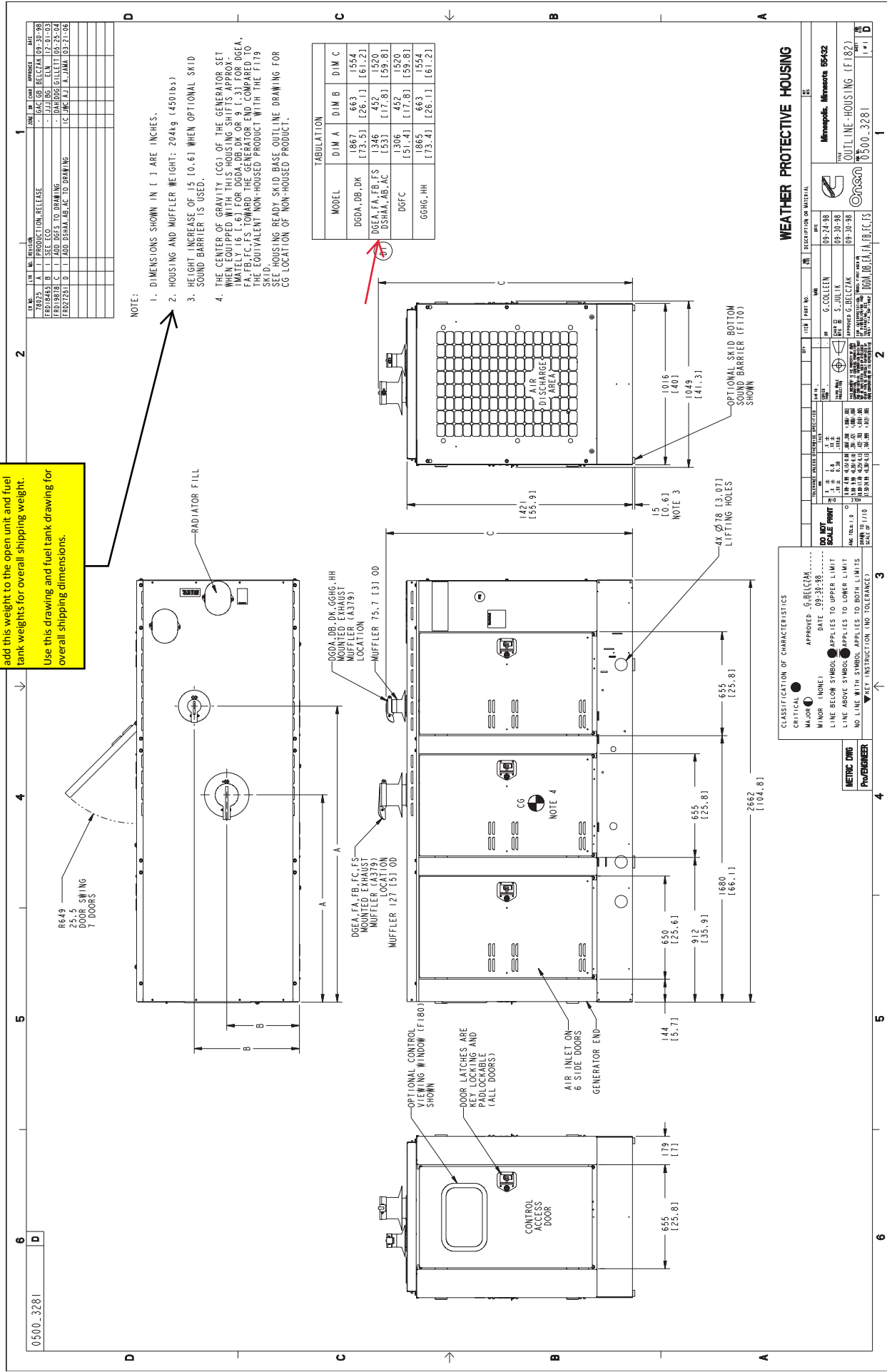
Level 2 sound attenuated

Kilowatt rating	Tank size	Length (in.)	Width (in.)	Height (in.)	Weight (lbs)
35 - 80 kW	70 gallon tank	102	40	83	1443 steel, 1186 aluminum
	140 gallon tank	102	40	91	1593 steel, 1336 aluminum
	185 gallon tank	102	40	95	1695 steel, 1438 aluminum
100 - 230 kW	109 gallon tank	142	40	87	1904 steel, 1538 aluminum
	173 gallon tank	142	40	92	2030 steel, 1664 aluminum
	309 gallon tank	145	43	97	5852 steel, 4780 aluminum
	336 gallon tank	142	40	106	2263 steel, 1897 aluminum
	376 gallon tank	149	43	99	6357 steel, 5286 aluminum

Level 3 sound attenuated

Kilowatt rating	Tank size	Length (in.)	Width (in.)	Height (in.)	Weight (lbs)
100 - 200 kW	309 gallon tank	158	43	97	6052 steel, 4852 aluminum
	376 gallon tank	162	43	99	6557 steel, 5358 aluminum

add this weight to the open unit and fuel tank weights for overall shipping weight.
Use this drawing and fuel tank drawing for overall shipping dimensions.



MODEL	DIM A	DIM B	DIM C
DGEA, DB, DK	1867 [73.5]	663 [26.1]	1554 [61.2]
DGEA, FA, FB, FS	1346 [53]	452 [17.8]	1520 [59.8]
DSHA, AB, AC	1306 [51.4]	452 [17.8]	1520 [59.8]
DGFC	1865 [73.4]	663 [26.1]	1554 [61.2]
GGHG, HH	1865 [73.4]	663 [26.1]	1554 [61.2]

- NOTE:
1. DIMENSIONS SHOWN IN 1, 1 ARE INCHES.
 2. HOUSING AND MUFFLER WEIGHT: 204kg (450lbs)
 3. HEIGHT INCREASE OF 15 (0.6) WHEN OPTIONAL SKID SOUND BARRIER IS USED.
 4. THE CENTER OF GRAVITY (CG) OF THE GENERATOR SET WHEN EQUIPPED WITH THIS HOUSING SHIFTS APPROXIMATELY 16 (0.6) FOR DGEA, DB, DK OR 9 (0.3) FOR DGEA, FA, FB, FC, FS TOWARD THE GENERATOR END COMPARED TO THE EQUIVALENT NON-HOUSED PRODUCT WITH THE F179 SKID. SEE HOUSING READY SKID BASE OUTLINE DRAWING FOR CG LOCATION OF NON-HOUSED PRODUCT.

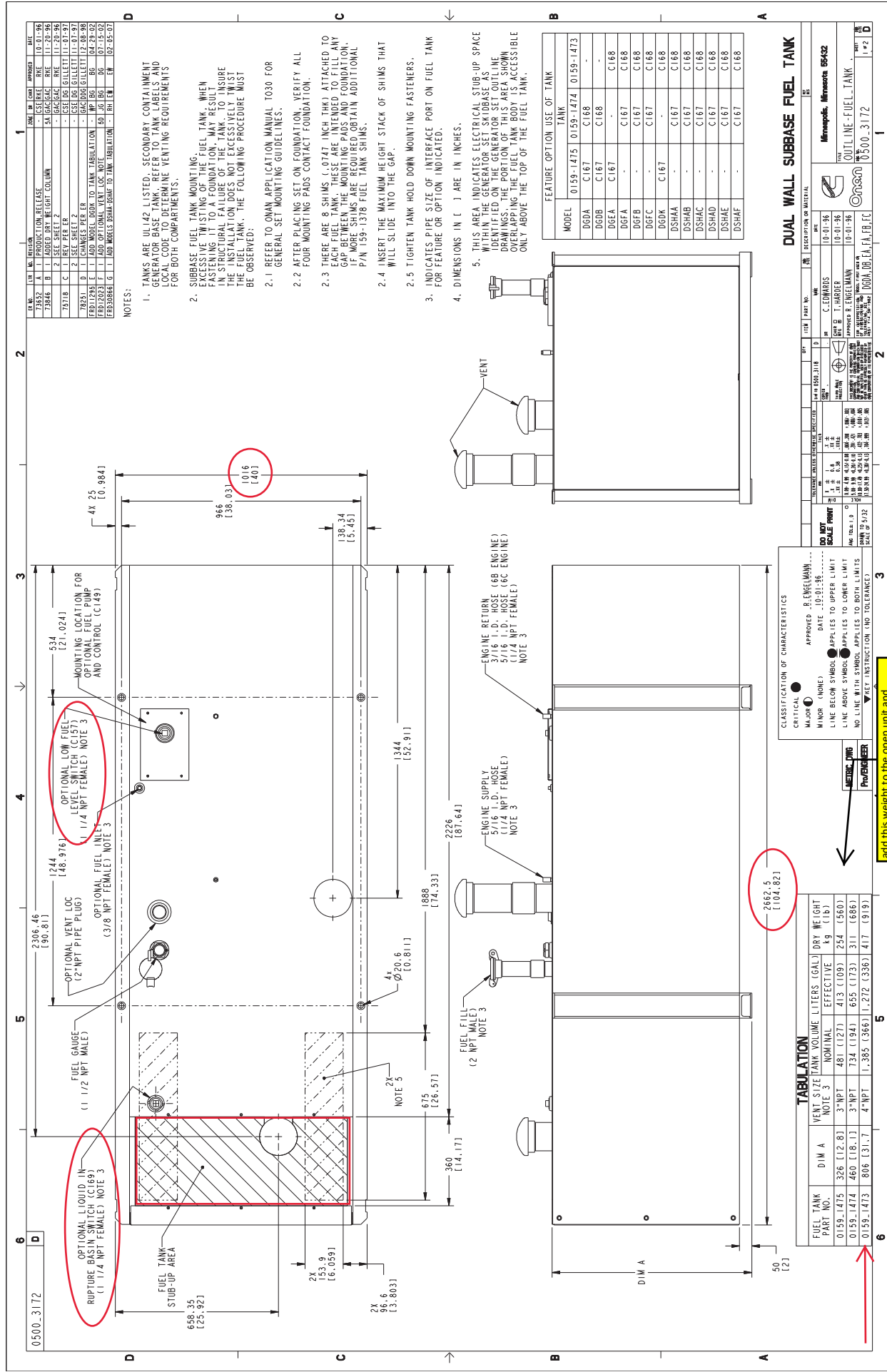
WEATHER PROTECTIVE HOUSING

CLASSIFICATION OF CHARACTERISTICS	APPROVED - G.BELTZM	DATE - 09-20-98
CRITICAL		
MAJOR		
MINOR (NONE)		
LINE ABOVE SYMBOL	APPLIES TO UPPER LIMIT	
LINE BELOW SYMBOL	APPLIES TO LOWER LIMIT	
NO LINE WITH SYMBOL	APPLIES TO BOTH LIMITS	
PREY	INSTRUCTION (AND TOLERANCE)	

DO NOT SCALE PRINT

DATE: 09-20-98
DRAWN: G. BELTZM
CHECKED: G. BELTZM
APPROVED: G. BELTZM

MINNESOTA 65432
OUTLINE HOUSING (F182)
0500_3281



REV	NO.	DESCRIPTION	DATE	BY	CHKD	APPROVED	DATE
1	1	ISSUED FOR CONSTRUCTION	11-20-96	SA	SA	SA	11-20-96
2	1	ADDED DRY WEIGHT COLUMN	11-20-96	SA	SA	SA	11-20-96
3	1	REV PER PER	11-01-97	SA	SA	SA	11-01-97
4	1	REV PER PER	11-01-97	SA	SA	SA	11-01-97
5	1	REV PER PER	11-01-97	SA	SA	SA	11-01-97
6	1	REV PER PER	11-01-97	SA	SA	SA	11-01-97
7	1	REV PER PER	11-01-97	SA	SA	SA	11-01-97
8	1	REV PER PER	11-01-97	SA	SA	SA	11-01-97
9	1	REV PER PER	11-01-97	SA	SA	SA	11-01-97
10	1	REV PER PER	11-01-97	SA	SA	SA	11-01-97
11	1	REV PER PER	11-01-97	SA	SA	SA	11-01-97
12	1	REV PER PER	11-01-97	SA	SA	SA	11-01-97
13	1	REV PER PER	11-01-97	SA	SA	SA	11-01-97
14	1	REV PER PER	11-01-97	SA	SA </tr		

NOTES:

- TANKS ARE UL142 LISTED. SECONDARY CONTAINMENT GENERATOR BASE TANK. REFER TO TANK LABELS AND LOCAL CODES FOR THE VENTING REQUIREMENTS FOR BOTH COMPARTMENTS.
- SUBBASE FUEL TANK MOUNTING. EXCESSIVE TWISTING OF THE FUEL TANK, WHEN FASTENING TO A FOUNDATION, MAY RESULT IN THE SUBBASE FUEL TANK BEING DAMAGED. TO ENSURE THE INSTALLATION DOES NOT EXCEED THE TOLERANCE OF THE FUEL TANK, THE FOLLOWING PROCEDURE MUST BE OBSERVED:
 - REFER TO ONAN APPLICATION MANUAL T030 FOR GENERAL SET MOUNTING GUIDELINES.
 - AFTER PLACING SET ON FOUNDATION, VERIFY ALL FOUR MOUNTING PADS CONTACT FOUNDATION.
 - THERE ARE 8 SHIMS (1.071 INCH THK) ATTACHED TO EACH FUEL TANK. THESE ARE INTENDED TO FILL ANY GAP BETWEEN THE MOUNTING PADS AND FOUNDATION. IF MORE SHIMS ARE REQUIRED, OBTAIN ADDITIONAL P/N 159-1378 FUEL TANK SHIMS.
 - INSERT THE MAXIMUM HEIGHT STACK OF SHIMS THAT WILL SLIDE INTO THE GAP.
 - TIGHTEN TANK HOLD DOWN MOUNTING FASTENERS.
- INDICATES PIPE SIZE OF INTERFACE PORT ON FUEL TANK FOR FEATURE OR OPTION INDICATED.
- DIMENSIONS IN [] ARE IN INCHES.
- THIS AREA INDICATES ELECTRICAL STUB-UP SPACE WITH THE GENERATOR SUBBASE AS SHOWN IN THE DRAWINGS. THE PORTION OF THIS AREA SHOWN OVERLAPPING THE FUEL TANK BODY IS ACCESSIBLE ONLY ABOVE THE TOP OF THE FUEL TANK.

MODEL	0159-1475	0159-1474	0159-1473
DGDA	C167	C168	-
DGDB	C167	C168	-
DGEA	C167	-	C168
DGFA	-	C167	C168
DGFB	-	C167	C168
DGFC	-	C167	C168
DGDK	C167	-	C168
DSHA	-	C167	C168
DSHAB	-	C167	C168
DSHAC	-	C167	C168
DSHAD	-	C167	C168
DSHAE	-	C167	C168
DSHAF	-	C167	C168

DUAL WALL SUBBASE FUEL TANK

RECEPTION OR RETAIL

MINNESOTA, MINNESOTA 55432

OUTLINE-FUEL-TANK

0500-3172

CLASSIFICATION OF CHARACTERISTICS	APPROVED	DATE
CRITICAL	E. ENGELMANN	10-21-96
MAJOR	(NONE)	
MINOR	(NONE)	

DO NOT SCALE PRINT

DATE: 10-21-96

APPLIES TO UPPER LIMIT

APPLIES TO LOWER LIMIT

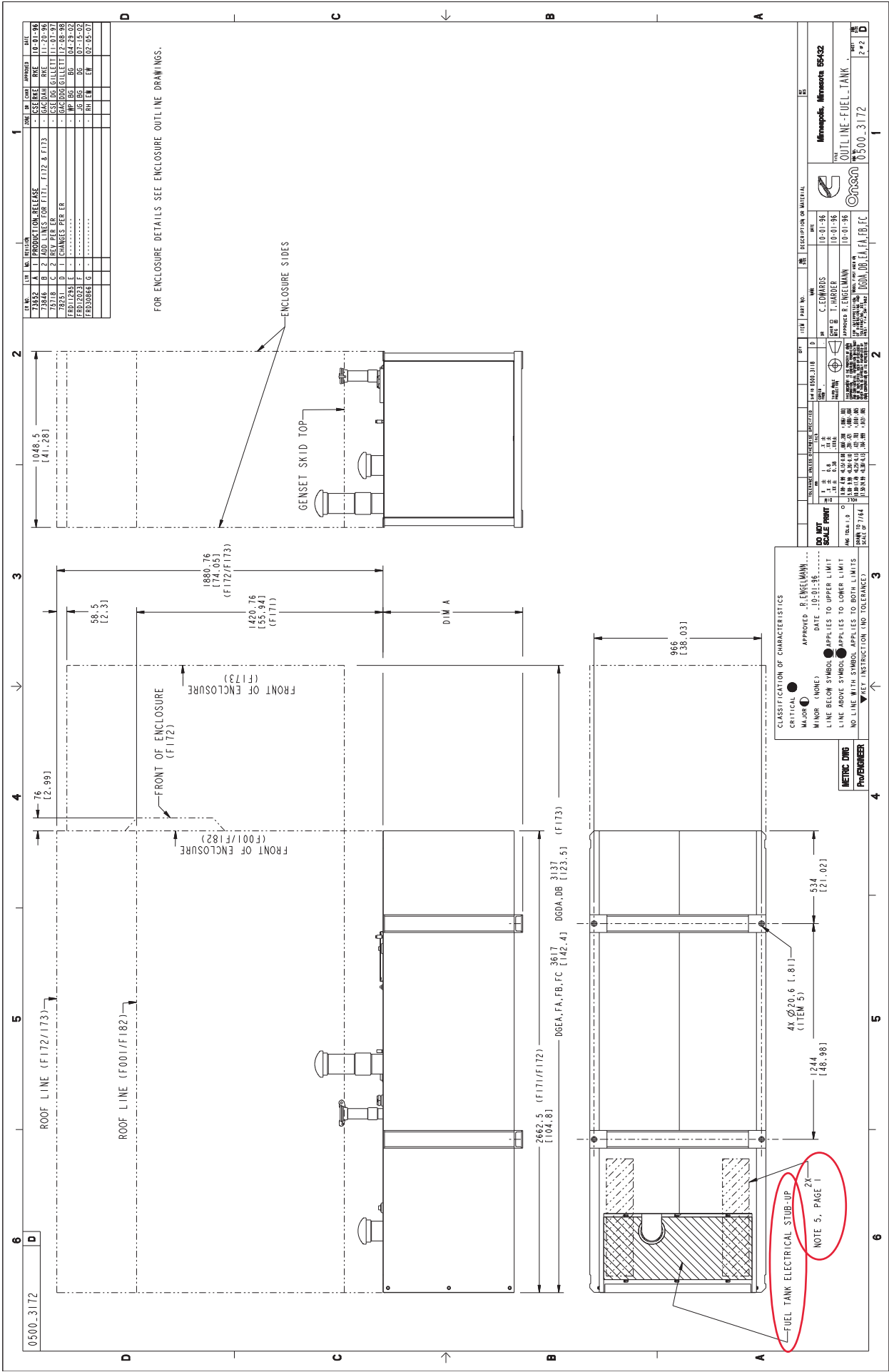
NO LINE WITH SYMBOL APPLIES TO BOTH LIMITS

KEY: INSTRUCTION AND TOLERANCE

FUEL TANK PART NO.	DIM A	VENT SIZE	TANK VOLUME	LITERS (GAL)	DRY WEIGHT
0159-1475	326 (12.8)	3" NPT	481 (127)	413 (109)	254 (560)
0159-1474	460 (18.1)	3" NPT	734 (194)	655 (173)	311 (686)
0159-1473	806 (31.7)	4" NPT	1,385 (366)	1,272 (336)	417 (919)

add this weight to the open unit and enclosure weights for overall shipping weight.

Use this drawing and enclosure drawing for overall shipping dimensions.



Battery Charger

A048G602 10A 50/60 Hz

A051H785 20A 50/60 Hz



Description

Cummins Power Generation fully automatic battery chargers are constant voltage/constant current chargers incorporating a 4-stage charging algorithm. Designed for use in applications where battery life and reliability are important; these chargers, complete with built-in equalize charge capability, are ideal for stationary or portable starting battery charging service.

To achieve optimum battery life, a 4-stage charging cycle is implemented. The four charging stages are constant current, high-rate taper charge, finishing charge, and maintaining charge. During the constant current cycle the charger operates at maximum possible output in the fast charge mode. During the high-rate taper charge cycle the charger stays at fast charge voltage level until battery current acceptance falls to a portion of the charger rated output. During the finishing charge cycle the charger operates at the float voltage and completes the battery charge. During the maintaining charge cycle the charger supplies only a few milliamps required by the battery to stay at peak capability.

An optional temperature sensor (A043D534) may be used to adjust charging voltage based on temperature of the battery. Use of a battery temperature sensor helps to increase battery life by preventing over or under charging. The battery temperature sensor also protects the battery from overheating. Temperature compensation sensor is required for all applications when battery charger and battery are located in different temperature or battery heater is being used.

Battery chargers are field-configurable for charging either 12 or 24 VDC battery systems at 50/60 Hz operation. Simple jumper selectors enable selection of output voltage and battery type.

Features

Protection – Surge protected to IEEE and EN standards. All models include single pole cartridge type fuses mounted on the printed circuit board to protect against input or output overcurrent.

Easy installation – Clearly marked terminal blocks and panel knockouts provide convenient connections of input and output leads.

User display – Output voltage and current, fault information and status are indicated on the front panel. Includes precision ammeter and voltmeter.

Monitoring – Status LED indicators are provided to show the condition of the charger. LED's on the right side of the monitor indicate operational functions for Temperature Compensation active (Green), AC on (Green), Float (Green) or Boost (Amber) mode, as well as Battery Fault (Red). LED's on the left side of the monitor illuminate (in Red) when Charger fail, High or Low VDC or AC fail occur.

Adjustable float voltage – Float voltage can be set, using easy to understand jumpers, for optimum battery performance and life.

Construction – NEMA-1 (IP20) corrosion resistant aluminum enclosure designed for wall mounting.

Faults – The charger senses and annunciates the following fault conditions: AC power loss, battery overvoltage, battery under voltage, battery fault conditions and charger failure. Includes an individual 30 volt/2 amp isolated contact for each alarm.

Vibration resistant design – complies with UL991 class B vibration resistance requirements.

Listed – C-UL listed to UL 1236 CSA standard 22.2 No 107.2-M89. Suited for flooded and AGM lead acid and NiCd batteries in generator set installations.

Warranty – 5 year CPG warranty.



Status and Fault LED



Field selectable jumper

Specifications

Performance and physical characteristics

Output:	Nominal voltage	12VDC* or 24VDC
	Float voltage– 12VDC batteries	12.87, 13.08, 13.31, 13.50*, 13.62, 14.30
	Float voltage– 24VDC batteries	25.74, 26.16, 26.62, 27.00*, 27.24, 28.60
	Equalize-voltage	6.5% above float voltage sensing
	Output voltage regulation	±0.5% (1/2%) line and load regulation
	Maximum output current	10 or 20 amps nominal
	Equalize charging	Battery interactive auto-boost
Input:	Voltage AC	120, 208, 240 ±10%
	Frequency	60/50 Hz ±5%
Approximate net weight:		10A: 25 lbs. (11.36 Kg) 20A: 50 lbs. (22.68 Kg)
Approximate dimensions: height x width x depth-in		10A: 12.50" x 7.66" x 6.50"(318x195x165 mm) 20A: 13.06" x 13.95" x 6.83"(332x354x173 mm)
Ambient temperature operation: At full rated output		- 4°F to 104 °F (-20 °C to 45 °C)

Note:

- Battery charger comes with default settings of 12VDC and 13.50/27.00VDC float voltage and can be changed to the battery manufacture recommendations. Replacement printed circuit board and fuses are identified in the Owner's Manual (10A: A050S537 and 20A: A051X126) which resides in Quick Serve On-Line. Service parts can be purchased through the Memphis Distribution Center. The PC board replacement instruction sheet (10A: A052N073, 20A: A053W929) and service manual (A050D829) is also available.
- Installation and application must comply with "section 4.5.3 batteries and battery charger" of application guide T-030 (Liquid Cooled Generator Set Application Manual A040S369).

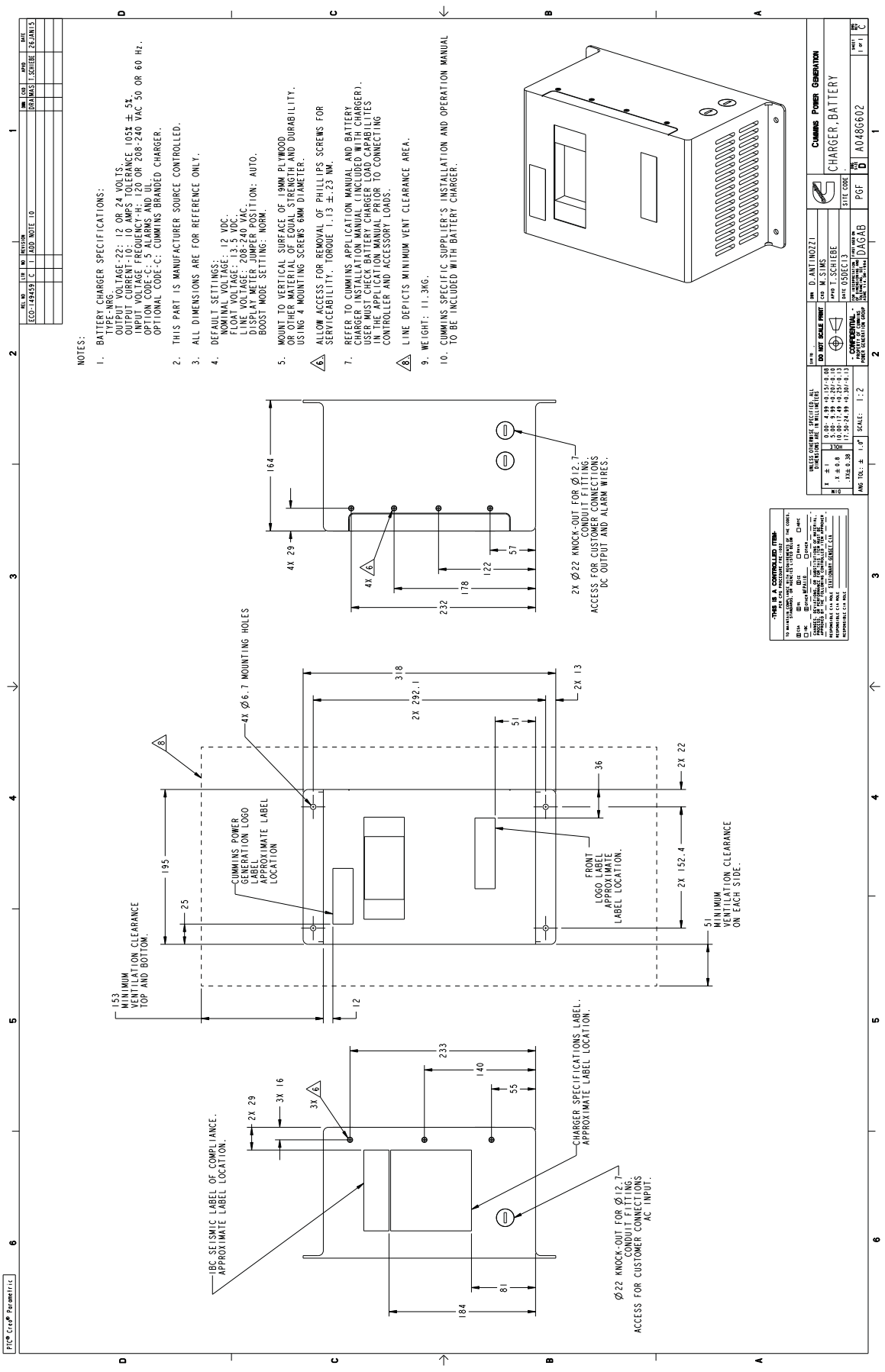
Caution:

- Higher input voltages (i.e. 480VAC or 600VAC) can be applied if a transformer with a 120VAC-240VAC output is installed. For voltages higher than 240 VAC, step-down transformer must be used. Review the respective Owner/Installation manual A050S537 for 10Amp and A051X126 20A chargers for supplier recommended step-down transformer requirements.
- 10Amp battery charger is recommended for genset applications with 1 or 2 factory provided batteries. 20Amp battery charger is recommended for Cummins Genset applications with 3 or 4 factory provided batteries. Please consider the auxiliary DC loads connected to the genset batteries and size this charger as per the T-030 application guide to prevent misapplication issues.
- Back feed to a utility system can cause electrocution and/or property damage. Do not connect generator sets to any building electrical system except through an approved device or after building main switch is open.
- For professional use only. Must be installed by a qualified service technician. Improper installation presents hazards of electrical shock and improper operation, resulting in severe personal injury and/or property damage.
- Use this charger for charging LEAD-ACID or LIQUID ELECTROLYTE NICKEL-CADMIUM batteries only. Do not use this battery charger for charging dry cells, alkaline, lithium, nickel-metal hydride, or sealed nickel-cadmium batteries that are commonly used with home appliances. These batteries may burst and cause injuries to persons and damage to property.
- Do not parallel these battery chargers with any other charging system.

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1400 73rd Avenue N.E.
Minneapolis, MN 55432 USA
Phone: 763 574 5000
Fax: 763 574 5298

Europe, CIS, Middle East and Africa
Manston Park Columbus Ave.
Manston Ramsgate
Kent CT 12 5BF United Kingdom
Phone 44 1843 255000
Fax 44 1843 255902

Asia Pacific
10 Toh Guan Road #07-01
TT International Tradepark
Singapore 608838
Phone 65 6417 2388
Fax 65 6417 2399



- NOTES:
1. BATTERY CHARGER SPECIFICATIONS:
TYPE: IRS
OUTPUT VOLTAGE: 22, 12 OR 24 VOLTS.
OUTPUT CURRENT: 10, 10 AMPS TOLERANCE $10\% \pm 5\%$.
OPERATING FREQUENCY: 50 OR 200-240 VAC 50 OR 60 HZ.
OPTIONAL CODE: 5 ALARMS AND 10 ALARMS.
OPTIONAL CODE: C: CUMMINS BRANDED CHARGER.
 2. THIS PART IS MANUFACTURER SOURCE CONTROLLED.
 3. ALL DIMENSIONS ARE FOR REFERENCE ONLY.
 4. DEFAULT SETTINGS:
MANUAL SETTING: 12 VDC.
FLOAT VOLTAGE: 13.5 VDC.
LINE VOLTAGE: 208-240 VAC.
DISPLAY METER JUMPER POSITION: AUTO.
BOOST MODE SETTING: NORM.
 5. MOUNT TO VERTICAL SURFACE OF 19MM PLYWOOD OR OTHER MATERIAL OF EQUAL STRENGTH AND DURABILITY. USING 4 MOUNTING SCREWS 6MM DIAMETER.

6. ALLOW ACCESS FOR REMOVAL OF PHILLIPS SCREWS FOR SERVICEABILITY. TORQUE 1.13 \pm 0.23 NM.
7. REFER TO CUMMINS APPLICATION MANUAL AND BATTERY USER MANUAL FOR BATTERY CHARGER (BATTERY CHARGER) IN THE APPLICATION MANUAL PRIOR TO CONNECTING CONTROLLER AND ACCESSORY LOADS.
8. LINE DEFECTS MINIMUM VENT CLEARANCE AREA.
9. WEIGHT: 11.3KG.
10. CUMMINS SPECIFIC SUPPLIER'S INSTALLATION AND OPERATION MANUAL TO BE INCLUDED WITH BATTERY CHARGER.

SIZE	Ø 12.7	Ø 12.7	Ø 12.7	Ø 12.7
Ø 12.7	0.00	0.00	0.00	0.00
Ø 12.7	0.00	0.00	0.00	0.00
Ø 12.7	0.00	0.00	0.00	0.00
Ø 12.7	0.00	0.00	0.00	0.00
Ø 12.7	0.00	0.00	0.00	0.00

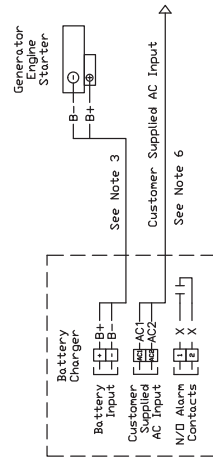
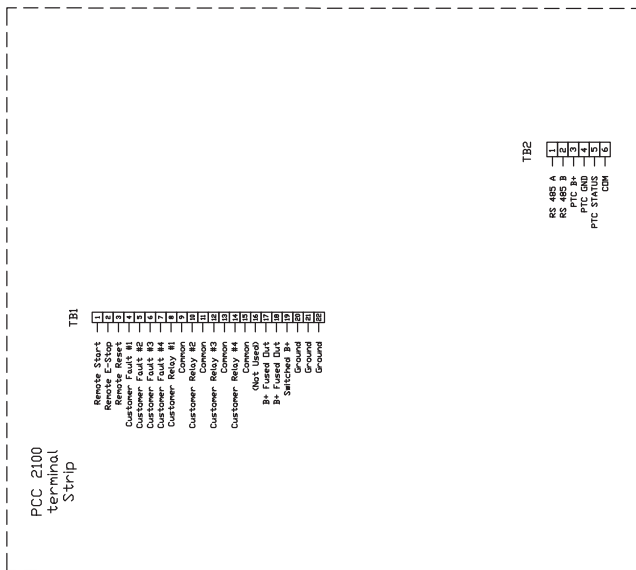
REV	DATE	BY	CHKD	DESCRIPTION
1				ISSUED FOR CONSTRUCTION

REV	DATE	BY	CHKD	DESCRIPTION
1				ISSUED FOR CONSTRUCTION

Drawing Name: A048G603 Revision: C
Part Name: A048G602 Revision: C
Sheet 1 of 2

NOTES:

1. PCC NET network cable use Belden 9729 or equivalent. See Cummins documentation for max distances and further detail.
2. N/A
3. See wire size chart in battery charger installation manual or NEC guide.
4. Pull 20% extra wires on all runs for spares.
5. N/A
6. See BDM for voltage.



Limited Warranty

Commercial Generating Set

This limited warranty applies to all Cummins Power Generation® branded commercial generating sets and associated accessories (hereinafter referred to as "Product").

This warranty covers any failures of the Product, under normal use and service, which result from a defect in material or factory workmanship.

Warranty Period:

The warranty start date† is the date of initial start up, first rental, demonstration or 18 months after factory ship date, whichever is sooner. See table for details.

Continuous Power (COP) is defined as being the maximum power which the generating set is capable of delivering continuously whilst supplying a constant electrical load when operated for an unlimited number of hours per year. No overload capability is available for this rating.

Prime Power (PRP) is defined as being the maximum power which a generating set is capable of delivering continuously whilst supplying a variable electrical load when operated for an unlimited number of hours per year. The permissible average power output over 24 hours of operation shall not exceed 70% of the PRP. For applications requiring permissible average output higher than stated, a COP rating should be used.

Limited-Time Running Power (LTP) is defined as the maximum power available, under the agreed operating conditions, for which the generating set is capable of delivering for up to 500 hours of operation per year.

Emergency Standby Power (ESP) is defined as the maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a utility power outage or under test conditions for up to 500 hours of operation per year. The permissible average power output over 24 hours of operation shall not exceed 70% of the ESP.

Environmental Protection Agency – Stationary Emergency (EPA-SE) is defined as being the maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generator set is capable of delivering in the event of a utility power outage or under test conditions and used in strict accordance with the EPA NSPS for stationary engines, 40 CFR part 60, subparts IIII and JJJJ, where a reliable utility must be present. The permissible average power output over 24 hours of operation shall not exceed 70% of the EPA-SE.

Data Center Continuous (DCC) is defined as the maximum power which the generator is capable of delivering continuously to a constant or varying electrical load for unlimited hours in a data center application.

Base Warranty Coverage Duration (Whichever occurs first)

Rating	Months	Max. Hours
COP	12	Unlimited
PRP	12	Unlimited
LTP	12	500 hrs
ESP	24	1000 hrs
EPA-SE	24	Unlimited
DCC	24	Unlimited

† Warranty start date for designated rental and oil and gas model Products is determined to be date of receipt of Product by the end customer.

Cummins Power Generation® Responsibilities:

In the event of a failure of the Product during the warranty period due to defects in material or workmanship, Cummins Power Generation® will only be responsible for the following costs:

- All parts and labor required to repair the Product.
- Reasonable travel expenses to and from the Product site location.
- Maintenance items that are contaminated or damaged by a warrantable failure.

Owner Responsibilities:

The owner will be responsible for the following:

- Notifying Cummins Power Generation® distributor or dealer within 30 days of the discovery of failure.
- Installing, operating, commissioning and maintaining the Product in accordance with Cummins Power Generation®'s published policies and guidelines.
- Providing evidence for date of commissioning.
- Providing sufficient access to and reasonable ability to remove the Product from the installation in the event of a warrantable failure.
- Incremental costs and expenses associated with Product removal and reinstallation resulting from non-standard installations.
- Costs associated with rental of generating sets used to replace the Product being repaired.
- Costs associated with labor overtime and premium shipping requested by the owner.
- All downtime expenses, fines, all applicable taxes, and other losses resulting from a warrantable failure.

Limitations:

This limited warranty does not cover Product failures resulting from:

- Inappropriate use relative to designated power rating.
- Inappropriate use relative to application guidelines.
- Inappropriate use of an EPA-SE application generator set relative to EPA's standards.
- Normal wear and tear.
- Improper and/or unauthorized installation.
- Negligence, accidents or misuse.
- Lack of maintenance or unauthorized repair.
- Noncompliance with any Cummins Power Generation® published guideline or policy.
- Use of improper or contaminated fuels, coolants or lubricants.
- Improper storage before and after commissioning.
- Owner's delay in making Product available after notification of potential Product problem.
- Replacement parts and accessories not authorized by Cummins Power Generation®.
- Use of Battle Short Mode.
- Owner or operator abuse or neglect such as: operation without adequate coolant or lubricants; overfueling; overspeeding; lack of maintenance to lubricating, cooling or air intake systems; late servicing and maintenance; improper storage, starting, warm-up, run-in or shutdown practices, or for progressive damage resulting from a defective shutdown or warning device.

- Damage to parts, fixtures, housings, attachments and accessory items that are not part of the generating set.

This limited warranty does not cover costs resulting from:

- Difficulty in gaining access to the Product.
- Damage to customer property.

A "Data center" is defined as a dedicated facility that house computers and associated equipment for data storage and data handling.

Reliable utility is defined as utility power without routine or regularly scheduled black-outs.

Please contact your local Cummins Power Generation® Distributor for clarification concerning these limitations.

CUMMINS POWER GENERATION® RIGHT TO FAILED COMPONENTS:

Failed components claimed under warranty remain the property of Cummins Power Generation®. Cummins Power Generation® has the right to reclaim any failed component that has been replaced under warranty.

Extended Warranty:

Cummins Power Generation® offers several levels of Extended Warranty Coverage. Please contact your local Cummins Power Generation® Distributor for details.

www.power.cummins.com

THE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS POWER GENERATION® IN REGARD TO THE PRODUCT. CUMMINS POWER GENERATION® MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

IN NO EVENT IS CUMMINS POWER GENERATION® LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

This limited warranty shall be enforced to the maximum extent permitted by applicable law. This limited warranty gives the owner specific rights that may vary from state to state or from jurisdiction to jurisdiction.

Product Model Number: _____
 Product Serial Number: _____
 Date in Service: _____